



Calhoun: The NPS Institutional Archive

Theses and Dissertations

Thesis Collection

2010-06

Analysis of implementing lifetime energy cost,
including fully burdened cost of fuel and energy
footprints of contractors, as mandatory decision
factors in navy acquisition

Murphy, Doug

Monterey California Naval Postgraduate School



Calhoun is a project of the Dudley Knox Library at NPS, furthering the precepts and goals of open government and government transparency. All information contained herein has been approved for release by the NPS Public Affairs Officer.

**Dudley Knox Library / Naval Postgraduate School
411 Dyer Road / 1 University Circle
Monterey, California USA 93943**

<http://www.nps.edu/library>



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

MBA PROFESSIONAL REPORT

**Analysis of Implementing Lifetime Energy Cost,
Including Fully Burdened Cost of Fuel and
Energy Footprints of Contractors, as
Mandatory Decision Factors in Navy Acquisition**

**By: Doug Murphy, and
Chris Wilson
June 2010**

**Advisors: Max Kidalov
E. Cory Yoder**

Approved for public release; distribution is unlimited

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE June 2010	3. REPORT TYPE AND DATES COVERED MBA Professional Report	
4. TITLE AND SUBTITLE Analysis of Implementing Lifetime Energy Cost, Including Fully Burdened Cost of Fuel and Energy Footprints of Contractors, as Mandatory Decision Factors in Navy Acquisition			5. FUNDING NUMBERS	
6. AUTHOR(S) Doug Murphy and Chris Wilson				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB Protocol number _____.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (maximum 200 words) <p>The Secretary of the Navy (SECNAV), the Honorable Ray Mabus, in an address to the Navy Energy Forum, announced as a new acquisition policy that the "lifetime energy cost of a building or a system, and the fully burdened cost of fuel in powering those, will be a mandatory evaluation factor used when awarding contracts." Secretary Mabus went on to say, "we will also use the overall energy efficiency and the energy footprint of a competing company as an additional factor in acquisition decisions" (Mabus, 2009). Secretary Mabus made this announcement and shared three other green and efficiency goals for the Department of the Navy. His address now puts the onus on the Navy acquisition community to implement the broad policy goals that he outlined. A challenge to the community will be how to implement these goals with a uniform, objective, and definable standard that is able to withstand the scrutiny of congress, which requires full and open competition, the business models of the defense industry, and the legal challenges that are sure to follow as a result of competition. This project analyzes the challenges of implementing Secretary Mabus's announcement. Our analysis further defines the problem, offers recommendations for proceeding, and suggests areas for further study.</p> <p>Specifically, in this project we first conduct a literature review in the areas of total ownership cost, including the fully burdened cost of fuel, and of measuring energy efficiency. We then lay out a methodology for examining the issues associated with the implementation of the SECNAV's announcement. Next, we survey and analyze available private-industry practices in the areas of green procurement or managing energy efficiencies, looking for possible implications for the Department of the Navy. We then explore the issues involved with the implementation of the SECNAV's policy by defining the elements of total ownership cost, delving deeper into the fully burdened cost of fuel, and examining the difficulties with quantifying the energy efficiencies of competing companies. Finally, we conclude the project with detailed recommendations for proceeding and suggestions for further study.</p>				
14. SUBJECT TERMS Total Ownership Cost, Lifetime Energy Cost, Lifecycle Energy Cost, Lifecycle Cost, Fully Burdened Cost of Fuel, Fully Burdened Cost Of Energy, Energy Efficiency, Energy Footprint, Mandatory Evaluation Factors, Navy Acquisition, Energy Management Systems, Corporate Social Responsibility			15. NUMBER OF PAGES 97	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UU	

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited

**ANALYSIS OF IMPLEMENTING LIFETIME ENERGY COST,
INCLUDING FULLY BURDENED COST OF FUEL AND
ENERGY FOOTPRINTS OF CONTRACTORS, AS
MANDATORY DECISION FACTORS IN NAVY ACQUISITION**

Doug Murphy, Lieutenant Commander, United States Navy
Chris Wilson, Lieutenant, United States Navy

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF BUSINESS ADMINISTRATION

from the

**NAVAL POSTGRADUATE SCHOOL
June 2010**

Authors:

Doug Murphy

Chris Wilson

Approved by:

Max Kidalov, Lead Advisor

E. Cory Yoder, Support Advisor

William R. Gates, Dean
Graduate School of Business and Public Policy

THIS PAGE INTENTIONALLY LEFT BLANK

ANALYSIS OF IMPLEMENTING LIFETIME ENERGY COST, INCLUDING FULLY BURDENED COST OF FUEL AND ENERGY FOOTPRINTS OF CONTRACTORS, AS MANDATORY DECISION FACTORS IN NAVY ACQUISITION

ABSTRACT

The Secretary of the Navy (SECNAV), the Honorable Ray Mabus, in an address to the Navy Energy Forum, announced as a new acquisition policy that the “lifetime energy cost of a building or a system, and the fully burdened cost of fuel in powering those, will be a mandatory evaluation factor used when awarding contracts.” Secretary Mabus went on to say, “we will also use the overall energy efficiency and the energy footprint of a competing company as an additional factor in acquisition decisions” (Mabus, 2009). Secretary Mabus made this announcement and shared three other green and efficiency goals for the Department of the Navy. His address now puts the onus on the Navy acquisition community to implement the broad policy goals that he outlined. A challenge to the community will be how to implement these goals with a uniform, objective, and definable standard that is able to withstand the scrutiny of congress, which requires full and open competition, the business models of the defense industry, and the legal challenges that are sure to follow as a result of competition. This project analyzes the challenges of implementing Secretary Mabus’s announcement. Our analysis further defines the problem, offers recommendations for proceeding, and suggests areas for further study.

Specifically, in this project we first conduct a literature review in the areas of total ownership cost, including the fully burdened cost of fuel, and of measuring energy efficiency. We then lay out a methodology for examining the issues associated with the implementation of the SECNAV’s announcement. Next, we survey and analyze available private-industry practices in the areas of green procurement or managing energy efficiencies, looking for possible

applications for the Department of the Navy. We then explore the issues involved with the implementation of the SECNAV's policy by defining the elements of total ownership cost, delving deeper into the fully burdened cost of fuel, and examining the difficulties with quantifying the energy efficiencies of competing companies. Finally, we conclude the project with detailed recommendations for proceeding and suggestions for further study.

After completing the project, the principle recommendation is that for Navy and Marine Corps acquisitions contractors put in place an energy management process rather than submit to an arbitrary yardstick for energy efficiency and footprint for their companies.

TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	BACKGROUND	1
B.	DEFENSE ACQUISITION SYSTEM	3
C.	THE FEDERAL ACQUISITION REGULATION SYSTEM: FULL & OPEN COMPETITION, MAXIMUM PRACTICABLE OPPORTUNITY FOR SMALL BUSINESS, AND OTHER PUBLIC- POLICY OBJECTIVES	8
D.	A WARFIGHTER’S REQUIREMENT	12
E.	SIGNIFICANCE THAT REFORMS WILL PLAY IN THE ACQUISITION PROCESS	13
II.	LITERATURE REVIEW	17
A.	SECNAV SPEECH TO NAVAL ENERGY FORUM	17
B.	TOTAL OWNERSHIP COST INCLUDING THE FULLY BURDENED COST OF FUEL.....	19
	1. More Capable Warfighting Through Reduced Fuel Burden, Report of the Defense Science Board, May 2001 .	19
	2. More Fight–Less Fuel: Report of the DSB on DoD Energy Strategy, February 2008	20
	3. Reducing DoD Fossil-Fuel Dependence, JASON the MITRE Corporation, September 2006.....	21
	4. Overarching Organizational Framework Needed to Guide and Oversee Energy Reduction Efforts for Military Operations, Government Accountability Office, March 2008.....	23
C.	MEASURING ENERGY EFFICIENCY	24
	1. Take the Stairs—Be More Energy Efficient, Department of Energy, Energy Information Administration, June 2000.....	25
	2. The Industrial Sector, DoE–Energy Information Administration, October 1999.....	25
	3. Green Building in Government Construction Contracting, American Bar Association	26
III.	METHODOLOGY.....	29
A.	DEFINITION	29
B.	CONCLUSION	29
IV.	PRIVATE/PUBLIC ORGANIZATION ENERGY PRACTICES: ARBITRARY YARDSTICK VS. ENERGY MANAGEMENT PROCESS.....	31
A.	PRIVATE SECTOR	32
	1. International Organization for Standardization (ISO)	32
	2. American National Standards Institute (ANSI)	37

3.	Wal-Mart.....	39
B.	PUBLIC SECTOR	43
1.	Laws, Executive Orders and Regulations.....	43
2.	Non-DoD Agencies	44
a.	<i>Department of Energy (DoE)</i>	45
b.	<i>Environmental Protection Agency (EPA)</i>	46
3.	DoD	47
a.	<i>Army</i>	47
b.	<i>Air Force</i>	48
C.	CHAPTER SUMMARY/ANALYSIS.....	49
V.	PROBLEM DEFINITION	53
A.	TOTAL OWNERSHIP COST	53
1.	Fully Burdened Cost of Fuel (FBCF)	58
B.	ENERGY EFFICIENCY AND FOOTPRINTS OF COMPETING COMPANIES.....	63
VI.	CONCLUSION	65
A.	FINDINGS	66
B.	RECOMMENDATIONS	67
C.	RECOMMENDATION FOR NAVY MARINE CORPS ACQUISITION REGULATIONS	68
D.	FURTHER STUDY	71
	LIST OF REFERENCES.....	73
	INITIAL DISTRIBUTION LIST	79

LIST OF FIGURES

Figure 1.	DoD Decision Support Systems (From: DAU, 2010)	3
Figure 2.	The Defense Acquisition Management System (From: USD (AT&L), 2008)	5
Figure 3.	Socio-economic Programs (From: DAU, 2010)	11
Figure 4.	Plan-Do-Check-Act Model (From: GTEEC, 2007b)	38
Figure 5.	15 Questions for Suppliers (From: Walmart, 2009)	42
Figure 6.	Notional Profile of Annual Program Expenditures by Cost Category over the System Lifecycle.....	55
Figure 7.	OUSD (AT&L)–Defined Cost Elements for FBCF.....	62

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

Table 1.	Description and Decision Authority for ACAT I—III Programs (From: USD (AT&L), 2008)	7
Table 2.	ISO 14001 versus ISO 50001 (From: Integrated Renewable Energy, 2010).....	35

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

A&T	Acquisition & Technology
ACAT	Acquisition Category Program
ANSI	American National Standards Institute
AoA	Analysis of Alternatives
AT&L	Acquisition, Technology, and Logistics
AT&L	Defense Acquisition Technology & Logistics
CAPE	Cost Assessment and Program Evaluation
CDR	Critical Design Review
CJCS	Chairman of the Joint Chiefs of Staff
CPG	Comprehensive Procurement Guidelines
CSR	Corporate Social Responsibility
DAG	Defense Acquisition Guidebook
DAU	Defense Acquisition University
DCMA	Defense Contract Management Agency
DDR&E	Director of Defense Research and Engineering
DESC	Defense Energy Supply Center
DFARS	Defense Federal Acquisition Regulation Supplement
DoD	Department of Defense
DoDISS	DoD Index of Specification and Standards
DoE	Department of Energy
DSB	Defense Science Board
EPA	Environmental Protection Agency
EPP	Environmentally Preferred Purchasing
FAR	Federal Acquisition Regulation
FBCE	Fully Burdened Cost of Delivered Energy
FBCF	Fully Burdened Cost of Fuel
FEMP	Federal Energy Management Program
GAO	Government Accountability Office
GHG	Green House Gas
GTEEC	Georgia Tech Energy and Environmental Center
HASC	House Committee on Armed Services
ISO	International Organization for Standardization

JCIDS	Joint Capabilities Integration and Development System
JROC	Joint Requirements Oversight Council
JUON	Joint Urgent Operational Need
KPP	Key Performance Parameter
LEED	Leadership in Energy and Environmental Design
MECS	Manufacturing Energy Consumption Survey
MOU	Memorandum of Understanding
MSE	Management System for Energy
NGO	Non-Governmental Organization
NMCARS	Navy and Marine Corps Acquisition Regulation Supplement
PM	Program Managers
PPB&E	Planning, Programming, Budgeting, and Execution Process
QDR	Quadrennial Defense Review
SECNAV	Secretary of the Navy
SEEP	Supplier Energy Efficiency Project
SFG	Senior Focus Group
TOC	Total Ownership Cost
USGBC	United States Green Building Counsel

ACKNOWLEDGMENTS

We would like to thank our spouses, Julie Wilson and Kylene Murphy, as well as our children, Megan and Brighton Wilson and Addison Murphy—for their tremendous love, support and encouragement in writing this MBA Project. We cannot express enough appreciation and thanks for the understanding as we dedicated ourselves to this research and you all sacrificed much.

We would also like to thank major contributors at NAVSEA, and the Office of the Deputy Assistance Secretary of the Navy for Acquisition and Logistics Management—who generously provided us with information, insights, and answers to our numerous questions.

Additionally, we would like to thank the Acquisition Research Program, especially RADM James Greene, USN (Ret), Ms. Karey Shaffer, and Ms. Tera Yoder, for providing funding, and resources to ensure the success of this MBA project.

Finally, we would like to thank Professors Max Kidalov, J.D., and CDR E. Cory Yoder, SC, USN (Ret), for their support, guidance, and encouragement throughout the duration of this project.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

A. BACKGROUND

The Secretary of the Navy (SECNAV), the Honorable Ray Mabus, has put forth three areas that will be a priority for the Navy and Marine Corps throughout his tenure: energy reform, acquisition reform, and unmanned systems. In an address to the Navy Energy Forum in October 2009, Secretary Mabus made a major announcement that would propel key changes and provide ambitious goals to address two of his three areas of priority. From that major announcement, quoted below, new acquisition policy emerged:

We are going to change the way the Navy and Marine Corps awards contracts. The lifetime energy cost of a building or a system, and the fully burdened cost of fuel in powering those, will be a mandatory evaluation factor used when awarding contracts. We are going to hold industry contractually accountable for meeting energy targets and system efficiency requirements. And we're going to do more. We will also use the overall energy efficiency and the energy footprint of a competing company as an additional factor in acquisition decisions. We want industry to partner with us and take steps not just to provide us with more energy efficient products, but to produce those products in energy efficient ways. (Mabus, 2009)

This announcement was accompanied by four additional green and efficiency goals for the Department of the Navy. These goals are as follows:

- Demonstrate a green strike group by 2012. The ships of the strike group will be powered by either nuclear or biofuel. By 2016, deploy that strike group as the Great Green Fleet, composed of nuclear ships and surface combatants that will operate using hybrid electric-propulsion systems and biofuel. The aircraft in the Green Strike Group will also operate solely on biofuels.
- Reduce the petroleum use in the commercial fleet of 50,000 vehicles by 50% by the year 2015. This reduction will be achieved by replacing current vehicles with flex-fuel vehicles, hybrid electric vehicles, and neighborhood electric vehicles.

- Produce at least half the energy requirements for shore-based installations from alternative energy. Sources for this energy will include wind, solar, ocean, and geothermal power.
- Secretary Mabus's most important target is to increase reliance on alternative energy sources for ships, aircraft, tanks, vehicles, and shore installations. This overarching goal is currently 17% complete. He plans to raise this to 50% by 2020. (Mabus, 2009)

These goals represent the impact that increased energy awareness is having across the entire federal government. The announcement of these goals in October was especially appropriate because it has been designated energy-awareness month. President George H. W. Bush made the official declaration in 1991, even though energy-awareness movements had been in practice since the early 1980s (DoE, 2009b). President Obama renewed energy-awareness in a press release dated October 2, 2009, in which he refocused the country's attention on the importance of energy awareness. In this press release, he stated that the federal government would lead the way in using clean energy and in increasing energy efficiency (Office of the Press Secretary, 2009a). As the largest energy consumer in the United States, the federal government will be able to leverage its buying power to promote the movement toward green technologies and energy sources in the marketplace, helping to develop an American "green" enterprise. The government will foster this movement through grants, increased funding, job-training programs, and policies that support clean energy businesses. President Obama called the expected results "benefits to our economic recovery, our security, and our long-term prosperity" (Office of the Press Secretary, 2009b). This renewed focus moves the federal government toward a larger role in implementing President Obama's desire to move to a green economy. The Secretary of the Navy is taking that role seriously, as his announcement on the new acquisition policy for the Navy and Marine Corps demonstrates.

B. DEFENSE ACQUISITION SYSTEM

To understand the importance of the SECNAV's new pronouncement on energy and energy-related guidelines as they relate to acquisition, a basic understanding of the Department of Defense's (DoD) acquisition system and phases is needed. DoD acquisition has often been referred to as a system-of-systems. Three decision-support systems combine to bring to life the processes of identifying capability needs, resourcing, and acquiring those capabilities for the DoD. Those decision support systems are the Joint Capabilities Integration and Development System (JCIDS): the Planning, Programming, Budgeting, and Execution Process (PPB&E): and the Defense Acquisition System. JCIDS is a need-driven system: PPB&E is a biennial calendar-driven system and the Defense Acquisition System is an event-driven system.

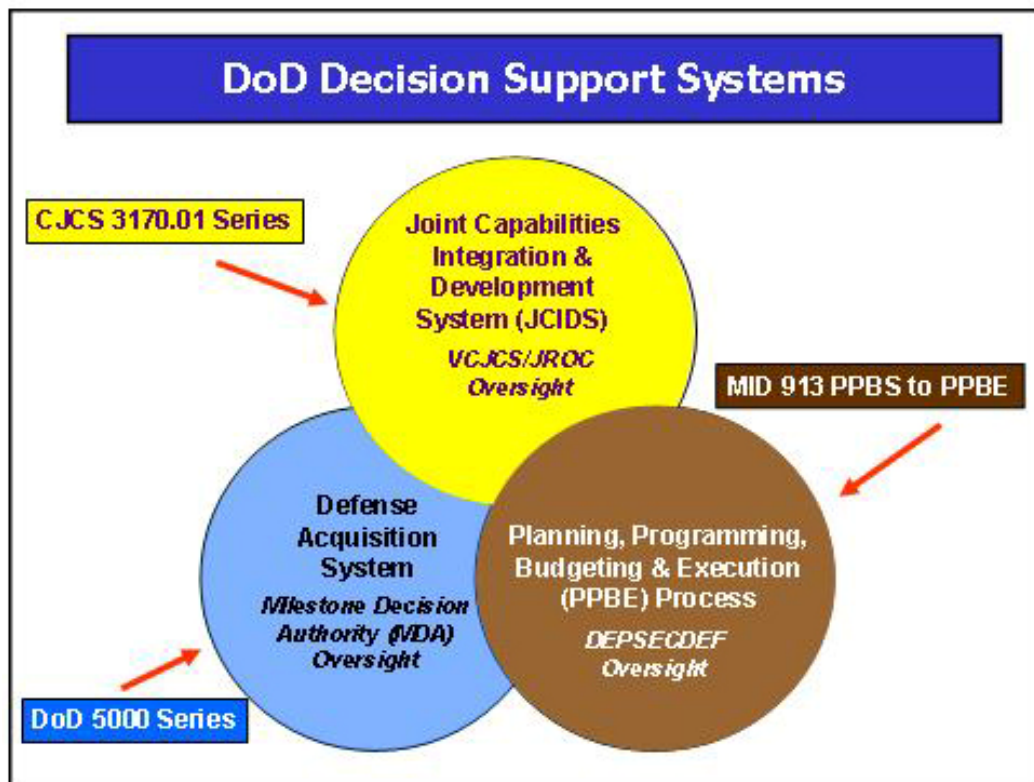


Figure 1. DoD Decision Support Systems (From: DAU, 2010)

As shown in the Figure 1 above, it is only with the proper interaction between these systems that the DoD can make informed resource decisions. The *Defense Acquisition Guidebook* defines the roles of the three decision support systems as follows:

- **JCIDS**—a system that identifies, documents, and prioritizes warfighting needs from a joint perspective. JCIDS focuses on identifying current and future gaps in meeting joint warfighting missions and functions and then develops requirements for weapon systems to close those gaps. The JCIDS process is conducted under the Joint Requirements Oversight Council (JROC), which is chaired by the Vice-chairman of the Joint Chiefs of Staff and membership consists of the Vice Chiefs of Staff for the Army and Air Force, the Vice Chief of Naval Operations, and the Assistant Commandant of the Marine Corps. The guiding instruction for JCIDS is the *Chairman of the Joint Chiefs of Staff (CJCS) 3170* series.
- **PPB&E**—a process that results in the allocation of resources for the DoD's proposed budget. PPB&E consists of four different overlapping phases in which guidance provided from the Secretary of Defense in terms of priorities, policy, and strategy shapes each Service's budget, and ultimately, the unified budget of the DoD. Additionally, the execution of the current budget, as approved by Congress and signed by the President, is managed within this system. *DoD Directive 7045.14* serves as the governing instruction.
- **Defense Acquisition System**—the management system for all DoD acquisition programs. It establishes the management guidance for turning the needs of the warfighter and technological opportunities into reliable, affordable and sustainable systems. It establishes different oversight requirements for programs based upon dollar amount, program complexity, and management interest. The system is governed by two instructions: *DoD Directives 5000.01 (The Defense Acquisition System)* and *5000.02—(Operation of the Defense Acquisition System)*.

Figure 2 shows the general framework for moving through the five phases of the defense acquisition process: (1) materiel solution analysis phase, (2) technology development phase, (3) engineering and manufacturing development phase, (4) production and deployment phase, and (5) operations and support phase.

Lifecycle Framework View

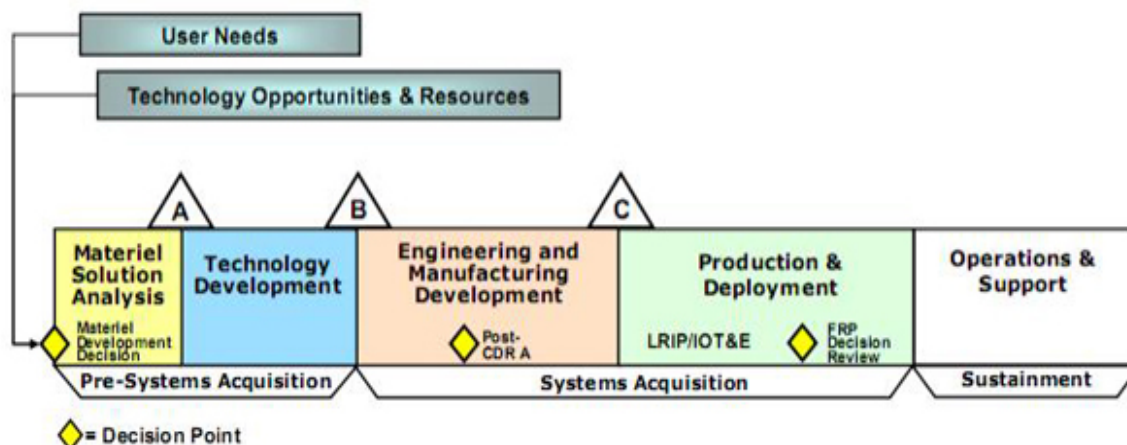


Figure 2. The Defense Acquisition Management System (From: USD (AT&L), 2008)

The SECNAV's announcement regarding new acquisition policies for energy and energy-related matters most clearly affects the Defense Acquisition System. As we discussed earlier, the other two systems concern themselves with identifying capability gaps and resourcing programs to meet those gaps, while the Defense Acquisition System focuses on managing programs within allotted resources to meet the gaps identified and, fulfill the warfighters' requirements. As such, the Defense Acquisition System provides the guidance under which programs will be run and along with the *Federal Acquisition Regulation (FAR)* contracts awarded for those programs—guidance that has now changed as a result of the SECNAV's announcement.

A deeper look at the Defense Acquisition System and its purpose is warranted to provide an understanding of the impact of the SECNAV's announcement. That understanding begins with the guidance spelled out in *DoD Directive 5000.01*. The policy statement of the DoD's Acquisition System follows:

4.1 The Defense Acquisition System exists to manage the nation's investments in technologies, programs, and product support necessary to achieve the National Security Strategy and support the United States Armed Forces. The investment strategy of the Department of Defense shall be postured to support not only today's force, but also the next force, and future forces beyond that.

4.2. The primary objective of Defense acquisition is to acquire quality products that satisfy user needs with measurable improvements to mission capability and operational support, in a timely manner, and at a fair and reasonable price. (USD (AT&L), 2007)

DoD Instruction 5000.02 lays out three overarching policies for achieving this purpose: flexibility, responsiveness, and innovation. It is also important to point out that acquisition and procurement are not synonyms that can be used interchangeably. Acquisition, in this case, refers to a process that encompasses an analysis of the requirement, design, engineering, test and evaluation, production, and operations and support of defense, or information-technology systems. Procurement is the act of buying goods and services for the government, which is only one of the many functions of the acquisition process. It is important to note that not all DoD procurements are subjected to the Defense Acquisition System and all the oversight requirements inherent in that process. It is only those procurements for weapons systems or weapons-related support systems or for information-technology systems that meet the required dollar thresholds or milestone decision authority interest to be designated an acquisition category program (ACAT) that are subject to the Defense Acquisition System. Table 1, from *DoD Instruction 5000.02*, illustrates the different categories of programs and their requirements:

Table 1. Description and Decision Authority for ACAT I—III Programs (From: USD (AT&L), 2008)

Acquisition Category	Reason for ACAT Designation	Decision Authority
ACAT I	<ul style="list-style-type: none"> MDAP (section 2430 of Reference (k)) <ul style="list-style-type: none"> Dollar value: estimated by the USD(AT&L) to require an eventual total expenditure for research, development, test and evaluation (RDT&E) of more than \$365 million in fiscal year (FY) 2000 constant dollars or, for procurement, of more than \$2.190 billion in FY 2000 constant dollars MDA designation MDA designation as special interest 	<p>ACAT ID: USD(AT&L)</p> <p>ACAT IC: Head of the DoD Component or, if delegated, the CAE (not further delegable)</p>
ACAT IA ^{1,2}	<ul style="list-style-type: none"> MAIS (Chapter 144A of Reference (k)): A DoD acquisition program for an Automated Information System³ (either as a product or a service) that is either: <ul style="list-style-type: none"> Designated by the MDA as a MAIS; or Estimated to exceed: <ul style="list-style-type: none"> \$32 million in FY 2000 constant dollars for all expenditures, for all increments, regardless of the appropriation or fund source, directly related to the AIS definition, design, development, and deployment, and incurred in any single fiscal year; or \$126 million in FY 2000 constant dollars for all expenditures, for all increments, regardless of the appropriation or fund source, directly related to the AIS definition, design, development, and deployment, and incurred from the beginning of the Materiel Solution Analysis Phase through deployment at all sites; or \$378 million in FY 2000 constant dollars for all expenditures, for all increments, regardless of the appropriation or fund source, directly related to the AIS definition, design, development, deployment, operations and maintenance, and incurred from the beginning of the Materiel Solution Analysis Phase through sustainment for the estimated useful life of the system. MDA designation as special interest 	<p>ACAT IAM: USD(AT&L) or designee</p> <p>ACAT IAC: Head of the DoD Component or, if delegated, the CAE (not further delegable)</p>
ACAT II	<ul style="list-style-type: none"> Does not meet criteria for ACAT I Major system <ul style="list-style-type: none"> Dollar value: estimated by the DoD Component Head to require an eventual total expenditure for RDT&E of more than \$140 million in FY 2000 constant dollars, or for procurement of more than \$660 million in FY 2000 constant dollars (section 2302d of Reference (k)) MDA designation⁴ (paragraph (5) of section 2302 of Reference (k)) 	<p>CAE or the individual designated by the CAE⁴</p>
ACAT III	<ul style="list-style-type: none"> Does not meet criteria for ACAT II or above AIS that is not a MAIS 	<p>Designated by the CAE⁴</p>

Acquisition Category	Reason for ACAT Designation	Decision Authority
	<ol style="list-style-type: none"> 1. In some cases, an ACAT IA program, as defined above, also meets the definition of an MDAP. The USD(AT&L) shall be the MDA for such programs unless delegated to a DoD Component. The statutory requirements that apply to MDAPs and MAIS shall apply to such programs. 2. The MDA (either the USD(AT&L) or, if delegated, the ASD(NII)/DoD CIO or another designee) shall designate MAIS programs as ACAT IAM or ACAT IAC. MAIS programs shall not be designated as ACAT II. 3. Automated Information System: A system of computer hardware, computer software, data or telecommunications that performs functions, such as collecting, processing, storing, transmitting, and displaying information. Excluded are computer resources, both hardware and software, that are: <ol style="list-style-type: none"> a. an integral part of a weapon or weapon system; b. used for highly sensitive classified programs (as determined by the Secretary of Defense); c. used for other highly sensitive information technology programs (as determined by the ASD(NII)/DoD CIO); or d. determined by the USD(AT&L) or designee to be better overseen as a non-AIS program (e.g., a program with a low ratio of RDT&E funding to total program acquisition costs or that requires significant hardware development). 4. As delegated by the Secretary of Defense or Secretary of the Military Department. 	

Programs that meet the threshold listed in Table 1 will be subject to the phases of the Defense Acquisition System and their varying oversight requirements: (1) materiel solution analysis phase, (2) technology development phase, (3) engineering & manufacturing development phase, (4) production and deployment phase, and (5) operations and support phase. Each phase of the program corresponds to a stage of its lifecycle: (1) pre-systems acquisition (materiel solution analysis phase, technology development phase), (2) systems acquisition (engineering and manufacturing development phase, production and deployment phase), and (3) sustainment (operations and support phase). The SECNAV's announcement most clearly affects guidance and policy for the pre-systems acquisition and systems acquisition stage in a program's lifecycle development while the benefits of the energy efficiencies are not typically seen until the sustainment stage of the system's lifecycle.

C. THE FEDERAL ACQUISITION REGULATION SYSTEM: FULL & OPEN COMPETITION, MAXIMUM PRACTICABLE OPPORTUNITY FOR SMALL BUSINESS, AND OTHER PUBLIC-POLICY OBJECTIVES

According to Garrett (2007) in *World Class Contracting*, a normal business analyzing a procurement program would focus on speed to market, cost reduction, and requirement satisfaction. The Department of Defense focuses on these areas within statutory and regulatory guidelines while also adding to the

mix other important public-policy objectives/goals and requirements. The *FAR* is the primary governing regulation for federal executive agencies in the acquisition process (and procurement process) of goods and services with appropriated funds. According to *FAR* 1.102, “the vision for the Federal Acquisition System is to deliver on a timely basis the best value product or service to the customer, while maintaining the public’s trust and fulfilling public policy objectives” (GSA et al., 2009). Furthermore, the *FAR* states the following with regard to public-policy objectives: “(d) *fulfill public policy objectives*. The system must support the attainment of public policy goals adopted by the Congress and the President. In attaining these goals, and in its overall operations, the process shall ensure the efficient use of public resources” (GSA et al., 2009).

In an article in *Defense Acquisition Technology & Logistics (AT&L)*, Krieger and Wood (2009) investigated the claim that if the DoD operated as a business, then its acquisition system and project management would function more effectively. In response to this claim, they stated the following as one of the reasons the DoD is not like a business: “as a large spender of taxpayer funds, [the] DoD is often the tool for implementing public policy—some having little to do with good business decisions or generating effective national defense” (p. 10). They went on to state that implementing public policy, “may contribute to the public good, but they [the DoD] do so in ways that no smart business would operate” (p. 10).

Given that the DoD does not function as a business and that instead it takes into consideration additional factors in support of public-policy objectives that may run contrary to good business practices, it becomes beneficial to define public-policy objectives/goals. In *FAR* 1.102-2(d), as stated above, public-policy goals are goals that Congress and the President adopt. This regulation commits the acquisition system to implementing and attaining such objectives as Congress and the President shall define. Existing socio-economic programs are

good examples of public-policy goals and how they have been implemented. In fact, the Defense Acquisition University (DAU) defines socio-economic programs in the following manner:

[Socio-economic are] programs that are incorporated into the procurement process to foster the achievement of national goals. The government utilizes its purchasing power as a means of promoting public policies. Government contracts attempt to further such national goals as fostering small business, overcoming regional unemployment, assisting minority workers, giving preference to domestic and other special sources, ensuring fair treatment of employees, maintaining integrity and fair competitive practices, and protecting the environment. (2009)

We could use a similar definition for a public-policy objective. As stated in the definition by the DAU, the government uses the purchasing power of the acquisition process to issue contracts in an effort to further national goals, and, in some instances, these contracts are issued without regard to the best or the most advantageous price for the government. The government has laid out a number of socio-economic categories, generally subject to oversight by the Small Business Administration, that fulfill important public-policy requirements and have established goals for each requirement category. Figure 3 details some of these socio-economic programs:

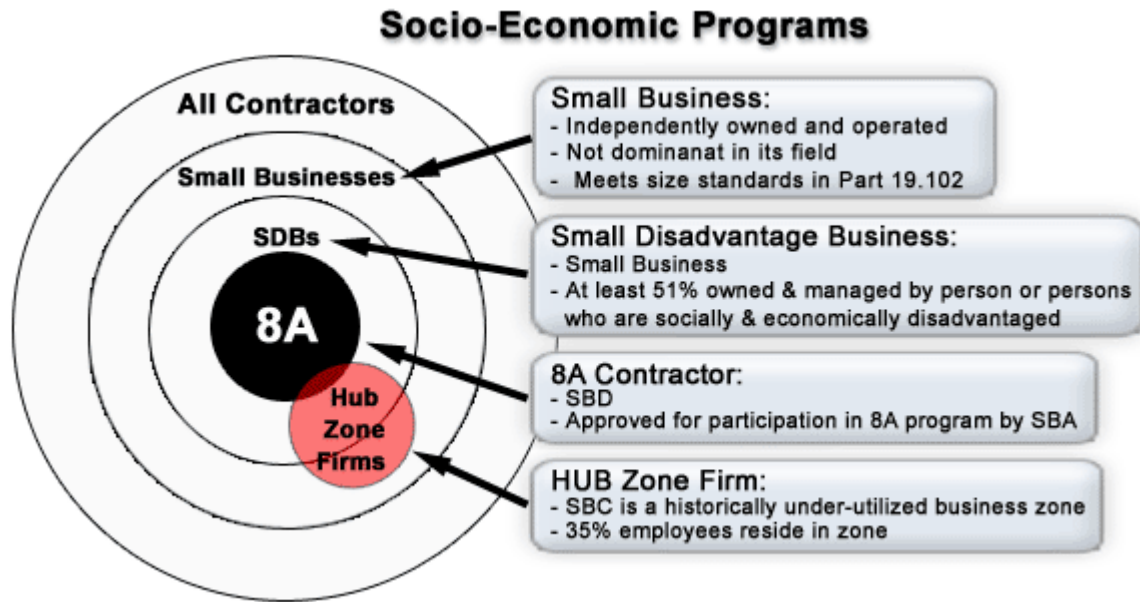


Figure 3. Socio-economic Programs (From: DAU, 2010)

Prior to the SECNAV's announcement on energy and energy-related mandatory evaluation factors, the federal government was pursuing public policy goals in the area of energy efficiency. *FAR 23* details a number of initiatives for the government in the areas of energy and water conservation. *FAR 23.202* states the policy as follows:

The government's policy is to acquire supplies and services that promote energy and water efficiency, advance the use of renewable energy products, and help foster markets for emerging technologies. This policy extends to all acquisitions, including those below the simplified acquisition threshold. (GSA et al., 2009)

This policy statement introduces to government acquisitions the public-policy goal of fostering markets for emerging technologies. This goal is similar in nature to President Obama's desire to use the acquisition processes of the Federal government to spur movement away from fossil fuels and towards renewable energy and the green economy. *FAR 23* lays out requirements for the acquisition of electronic items within the Federal Energy Star Program and Federal Energy Management Program, provides a preference for bio-based products, and

authorizes the use of energy savings performance contracts. The SECNAV's announcement on energy and energy-related matters reaches further than FAR 23 by extending energy requirements to be mandatory decision factors for Navy acquisitions.

D. A WARFIGHTER'S REQUIREMENT

In his book, *Alexander the Great and the Logistics of the Macedonian Army*, (Engels 1978) describes one of Alexander the Great's greatest strengths as the speed with which he could maneuver. Alexander the Great significantly limited the number of non-combatants who traveled with the army and kept the combat train (logistics tail) as small as possible, thus ensuring the speed of his army. He did this by limiting the supplies that would be carried by pack animals, reducing the ratio of servants to combatants to 1-to-4, and requiring his soldiers—rather than slaves—to carry their own gear. As Engels states:

Because many supplies were carried by the troops and a restricted number of servants, the Macedonian army would need far fewer pack animals than another contemporary force carrying an equivalent weight of baggage, and hence the problems of acquiring sufficient numbers of animals and feeding them were also reduced. The restricted use of carts would not only increase the army's mobility in rough terrain but also reduce the number of drivers and the need to carry or acquire replacement parts and lumber for repairs—an important consideration in the treeless areas of eastern Iran, Afghanistan, and Turkestan. In short, the logistics organization of Alexander's army was brilliantly adapted for campaigning in Asia, where the acquisition of pack animals and provisions would often be difficult in barren terrain and where speed and mobility were frequently important tactical advantages. (p. 24)

In Alexander the Great's time, the concern about logistics was with the combat train and the ability of that train to deliver food—the fuel for the army and pack animals—without limiting the range, mobility, and speed of the army. Today, that fear about the limits of the combat train still exists, and the modern combat train must provide greater amounts of fuel for the increasingly fuel-guzzling systems that are in use at the front lines, both for combat and support purposes.

As a recent example, in testimony provided to the House Committee on Armed Services Readiness Subcommittee, Chris Dipetto (2008), the Deputy Under Secretary of Defense Acquisition & Technology (A&T), recounted that in 2006 Major General Zilmer, while commander of U.S. forces in Al Anbar Province in Iraq, had issued a Joint Urgent Operational Need (JUON) statement to the Joint Staff. This JUON statement requested sustainable—energy equipment for his forward-operating bases. The general recognized that a vulnerability existed with the fuel-supply delivery system for his generators. Additionally, the General recognized that he was being forced to pull combat troops from offensive missions in order to ensure the protection of the fuel convoys. This shifting of personnel led to a decrease in the combat power available for offensive missions at the time. These examples highlight the impact and vulnerabilities of a force that requires a large logistics tail.

E. SIGNIFICANCE THAT REFORMS WILL PLAY IN THE ACQUISITION PROCESS

Two imperatives exist, both with potential secondary benefits, that have driven the DoD, and specifically the Navy, to consider energy-related criteria in the acquisition process. The first is in direct response to a warfighter's need to drive down the cost and size of a vulnerable logistics tail, and the second, which is discussed later in the project, is to drive down the total ownership costs of weapons and information systems over their lifecycle. It is important to begin the assessment of energy and its cost early during the acquisition process while planners are still able to address factors influencing the total ownership cost of the system. The factors influencing the total ownership cost of a system are set, with little room for movement, at the critical design review during the early stage of the engineering and manufacturing development phase of the Defense Acquisition System. At this point, the product baseline is set, the final design by product specifications, which is a significant controlling cost driver for total ownership cost. This product baseline will serve as the basis for going forward in the acquisition process. While the cost factors are set early in the acquisition

process or lifecycle of a system, the majority of the costs for the system and its lifecycle occur during the operations and support phase of the acquisition process. Estimates for the percentage of cost tied to a system's operations range upwards of 70 percent. With increasing strains anticipated on future DoD budgets, placing limits on these total ownership costs is a strategic imperative for the Navy.

In the Defense Acquisition System, there exist two main areas in which the DoD could consider lifetime energy costs including the fully burdened cost of fuel in the acquisition process for its weapon systems, platforms, and information systems. One of these areas is in the materiel solution analysis phase. During the Analysis of Alternatives (AoA), the lifetime energy cost including the fully burdened cost of fuel can be weighed against the requirement for the capability. In other words, during the AoA they are looking at the benefits of the capability and weighing them against the burdens created by fielding the capability. Once the capability requirement is verified during the AoA the second area is during the competition for that capability requirement when contractors can be forced to compete to offer the most energy-efficient solution and, therefore, the system with the lowest lifetime energy cost. Previous studies have focused on the fully burdened cost of fuel and its implication during the AoA. This project will take advantage of those studies in as much as they suggested a metric for determining or verifying the lifecycle energy cost of a system.

The Secretary of the Navy, the Honorable Ray Mabus, directed that lifecycle energy cost including the fully burdened cost of fuel and the energy efficiencies of competing companies become mandatory evaluation factors when the government awards contracts. This requirement now puts the onus on the Navy acquisition community to put into practice the broad policy goals Secretary Mabus outlined. A challenge to the acquisition community will be how to implement these goals with a uniform, objective, and definable standard that is

able to withstand the scrutiny of companies competing for Navy acquisition dollars and the court challenges that are sure to follow as a result of that competition.

This project addresses the issues involved with the implementation of the SECNAV's policy establishing mandatory evaluation factors for the lifecycle energy costs and the energy footprints of companies competing for contract awards. We examined these issues by defining the elements of total ownership cost, the fully burdened cost of fuel, and quantifying the energy footprints of competing companies. Additionally, we surveyed and analyzed available private-industry and other government agencies practices for green procurement and for defining energy efficiencies in order to evaluate their possible relevance to the Department of the Navy.

This project conducted a literature review in the areas of total ownership cost, including fully burdened cost of fuel, and measuring energy efficiency. In light of the elements involved with implementing the SECNAV's acquisition policy, the objectives for this project were as follows:

- Add definition to the complexity of implementing the SECNAV's policy announcement,
- Produce recommendations for how to proceed with the implementation of the new acquisition policy as defined in the SECNAV's announcement, and
- Make recommendations for areas of further study.

THIS PAGE INTENTIONALLY LEFT BLANK

II. LITERATURE REVIEW

This chapter reviews the SECNAV's speech to the Navy Energy Forum, breaking down his pronouncement on energy initiatives for acquisition into separate topics in order to facilitate a discussion of relevant existing literature. In this chapter, we break down the SECNAV's energy initiative into the following two areas: total ownership cost including the fully burdened cost of fuel, and energy efficiency measurement. We chose these areas because they line up directly with the new mandatory evaluation factors that the SECNAV announced. We begin the chapter begins by examining in more detail the speech given by the SECNAV announcing the energy initiatives. We then discuss a sampling of available literature in the areas of total ownership cost, including the fully burdened cost of fuel, and energy efficiency measurement. In this discussion, we will include a survey of the available pertinent literature in order to provide a basis for understanding the issues involved.

A. SECNAV SPEECH TO NAVAL ENERGY FORUM

The SECNAV's speech to the Naval Energy Forum, and specifically his announcement of energy and energy-related criteria becoming mandatory decision factors for Navy acquisitions, was the catalyst for this project. Thus, it is appropriate to start with a more detailed look at the SECNAV's speech.

During the speech, the SECNAV laid out three areas in which he will focus his leadership of the Navy and Marine Corps throughout his tenure: energy reform, acquisition reform, and unmanned systems. The speech to the Naval Energy Forum focused on energy and the importance that energy will play at a strategic, operational, and tactical level. Secretary Mabus laid out his case on energy and the importance of changing the mindset when it comes to energy. He made his case by stating, "energy reform is a strategic imperative. [...] And to a

certain extent we have ceded a strategic resource [energy/oil]—one that is difficult to guarantee—to other nations. We have ceded this to other nations who are allowed to exert disproportionate influence as a result” (Mabus, 2009).

The speech then went on to detail the history of innovation in the Navy for powering ships, advancing from sails to coal and then to oil. In detailing these shifts, Secretary Mabus compared the challenge of implementing these new ideas to the challenges that need to be overcome today. In talking about the present day, Secretary Mabus mentioned several initiatives underway to reform the Navy’s energy practices: an F/A-18 engine that was tested running on biofuels, and the plan to install in more ships a hybrid propulsion system like that on the USS MAKIN ISLAND. Secretary Mabus concluded his speech by laying out goals. These goals are mentioned in the previous chapter under section A, Background. The goals reflect his vision of where he plans to take the Navy and Marine Corps in the area of energy reform in the future. The first goal touches two of Secretary Mabus’s three primary areas, including energy reform and acquisition reform, which is the focus of this project.

The first goal that the SECNAV announced is that the lifetime energy cost, including the fully burdened cost of fuel, and the energy efficiency and footprint of competing companies would be mandatory evaluation criteria for the award of contracts. For the purpose of this literature review, we will break down this goal into the following areas: total ownership cost, including the fully burdened cost of fuel, and energy efficiency measurement. Next, we will cover in the literature review total ownership cost, including the fully burdened cost of fuel. Because the fully burdened cost of fuel is a component of total ownership cost, we have chosen to group them together here.

B. TOTAL OWNERSHIP COST INCLUDING THE FULLY BURDENED COST OF FUEL

With uncertain budget outlooks, efforts to derive the total ownership cost of the systems and weapons that the DoD and the Navy buy have only now come to the forefront. Due to the increasing energy demands of the weapons that the DoD has fielded, the DoD has also increased its attempt to quantify that energy demand in dollars as a portion of the total lifecycle cost of a weapon system or platform. What follows is a survey of the most commonly cited studies in this area. All of these studies point to the fact that the DoD and the Navy have systematically underestimated the cost of owning the weapon systems and platforms that they procure and maintain. Much of this underestimation is a result of their failure to take into account secondary, indirect, and tertiary costs—specifically those costs associated with the fully burdened cost of fuel, which can raise the overall costs exponentially depending on circumstances of the system's delivery.

Some of the items that make up the secondary and tertiary costs of fully burdened fuel include the following: transportation from source to end-user, security, equipment, infrastructure, training, actual delivery system, and maintenance of the delivery system. These secondary and tertiary costs, added to the commodity price of fuel, make up the fully burdened cost of fuel and lead to a more realistic picture of the total ownership cost over the lifecycle of the weapon system or platform.

1. More Capable Warfighting Through Reduced Fuel Burden, Report of the Defense Science Board, May 2001

In June, then Under Secretary of Defense, Acquisition, Technology, and Logistics (AT&L) Jacques Gansler issued a mandate for the formation of a Defense Science Board (DSB) to study and identify technologies that improve fuel efficiency across the portfolio of DoD weapon systems and to assess various impacts across a range of scenarios. Specifically, the mandate charged the

Board to “identify fuel-efficient technologies (broadly defined to include new or improved fuels, engines, Alternative Fueled Vehicles, and other advanced technologies) throughout research, development, test and evaluation pipeline, with an emphasis on those with greatest potential to begin implementation within the next 10 years” (DSB, 2001). The board evaluated the technologies based on four categories: operations, logistics, costs, and environment.

Among the findings of their report was the DoD’s practice of basing fuel price on the wholesale price of fuel and not on its delivered, or fully burdened, price. Thus, the DoD was not basing acquisition decisions on true costs and, therefore, was not rewarding efficiency innovations or penalizing inefficiencies. The study specifically pointed out figures from the Defense Energy Supply Center (DESC), which establishes the DoD-wide standard per-gallon fuel price. A price of \$1.337 was established for fiscal year 2002. The true cost of these fuels is much higher despite the DESC price. It costs an estimated \$17.50 per gallon for USAF worldwide tanker-delivered fuel and hundreds of dollars per gallon for Army forces deep into the battlespace. The report states, “these costs are not used in the economic analyses that form the basis for efficient investment decisions, which results in sub-optimal allocation of resources” (DSB, 2001).

As a result of these findings, the DSB recommended, among other things, that the DoD use the fully burdened cost of fuel in its investment decisions. It also concluded that the DoD should strengthen the link in the acquisition process between identifying the advantages (and quantifying those advantages) gained by fuel efficiencies to the four areas mentioned above: operations, logistics, costs, and environment.

2. More Fight–Less Fuel: Report of the DSB on DoD Energy Strategy, February 2008

In 2006, another DSB was formed with the mandate to once again examine the DoD’s energy practices and set a strategy for moving into the future. The findings from this DSB were consistent with those of the first Board in that

the fully burdened cost of fuel was still not playing an informative role in resource allocation. As a result, the DoD was making decisions not knowing the full extent of the consequences of those decisions in terms of budget, or the effects of those decisions on operations and force planning. Additionally, without a consistent methodology to identify the fully burdened cost of fuel and the risk associated with the energy demands of its weapons systems, the DoD was not able to take proper advantage of the trade space in the acquisition process. Other findings in their report concluded that the DoD's efforts in managing its energy were "currently limited to complying with executive orders, legislation and regulations, which are mostly limited to facilities, non-tactical fleet vehicles, purchase of renewable energy from utilities, and procurement of commercial products" (DSB, 2008). The report attributed these efforts to the fact that a senior political appointee was not responsible for energy and that the efforts in compliance made up a quarter of the DoD's energy consumption.

The DSB concluded in its 2008 report that the DoD faced two primary energy challenges: an unnecessarily high and growing fuel demand in the battlespace, and a military-installation dependence on commercial power that is fragile and vulnerable. As a result, the DSB once again recommended that the DoD base its acquisition decisions on the fully burdened cost of fuel and that it further develop the necessary analytical capabilities to quantify the value of the fully burdened cost of fuel. It further recommended that the DoD accomplish this goal by strengthening the link to energy factors in the acquisition process through the establishment of key energy-performance parameters, and by using the fully burdened cost of fuel to inform all trade-offs.

3. Reducing DoD Fossil-Fuel Dependence, JASON the MITRE Corporation, September 2006

In 2006, the Director of Defense Research and Engineering (DDR&E) charged JASON with examining ways to reduce the DoD's dependence on fossil fuels. In its findings, the report concluded that there was no expectation of any

prolonged shortages of petroleum based fuels in the next 25 years and that any short-term shortages would be a result of refinery capacity issues. Additionally, the report found that while fuel charges were only approximately 3% of the total DoD budget, there were still “compelling reasons” to reduce the DoD’s dependence on fossil fuels. The report stated:

Even though fuel is only a relatively small fraction of the total DoD budget, there are several compelling reasons to minimize DoD fuel use:

- a. Fuel costs represent a large fraction of the 40–50 year life-cycle costs of mobility aircraft and non-nuclear ships. Note that this is consistent with the life-cycle costs of commercial airliners.
- b. Fuel use is characterized by large multipliers and co-factors: at the simplest level, it takes fuel to deliver fuel.
- c. Fuel use imposes large logistical burdens, operational constraints and liabilities, and vulnerabilities: otherwise capable offensive forces can be countered by attacking more-vulnerable logistical-supply chains. Part of this is because of changes in military doctrine. In the past, we used to talk of the “front line,” because we used to talk of the line that was sweeping ahead, leaving relatively safe terrain behind. This is no longer true. The rear is now vulnerable, especially the fuel supply line.
- d. There are anticipated, and some already imposed, environmental regulations and constraints. Not least, because of the long life of many DoD systems.
- e. Uncertainties about an unpredictable future make it advisable to decrease DoD fuel use to minimize exposure and vulnerability to potential unforeseen disruptions in world and domestic supply. (JASON, 2006)

In its conclusion, the JASON report continued with the theme introduced in the DSB reports by stating that the DoD needed to maintain development of its analytical processes in order to be able to drive the estimates needed to make accurate and thoughtful resource decisions. The report specifically mentioned commercially available equipment, such as that on General Motors vehicles' ON-STAR, as a way in which the DoD could drill down into individual items to find actual efficiencies and use that information in forming and verifying its estimates. Additionally, the report stated that supply interruptions of fossil fuels would not be a deciding factor in military operations, but that the warfighter's needs for improved logistical and military requirements and capabilities and the requirement to hold costs down should be the factors forcing the DoD's hand in adopting an energy-efficiency metric or mindset.

4. Overarching Organizational Framework Needed to Guide and Oversee Energy Reduction Efforts for Military Operations, Government Accountability Office, March 2008

In 2008, the Government Accountability Office (GAO), at the request of the House Committee on Armed Services (HASC) Readiness Subcommittee, issued a report on the DoD's efforts to reduce its reliance on fossil fuels. In its report, the committee commented on many of the DoD's efforts to implement projects that would reduce fossil fuels. Specifically, the report mentioned the fact that energy transformation made the 2007 list of top departmental transformation priorities. The report also mentioned an update to the Joint Staff policy governing the development of capability documents for weapons systems. The policy requires energy efficiency and that it be selectively considered as a key performance parameter (KPP). The report goes on to detail a project that each of the services has implemented in order to cut fossil-fuel dependence.

However, in keeping with the trend in the DSB reports, the GAO faulted the DoD for its failure to have an overarching organizational framework to guide, coordinate, and oversee all these efforts. In echoing the 2008 DSB report, which called for a senior political appointee to oversee efforts, the GAO stressed the

importance of a single contact in order to ensure accountability—one who has the authority to usher in DoD wide goals. Additionally, the GAO faulted the DoD for its failure to establish a framework for implementing a KPP for fuel efficiency in acquiring its weapon system, again echoing earlier DSB reports.

Until now, the focus of this literature review has been on weapon systems, platforms, or buildings, and the fully burdened cost of fuel and total ownership cost in powering these items. The fully burdened cost of fuel and total ownership cost are areas in which extensive research has been documented and carried out to define and produce metrics or calculators in order to estimate the costs involved. Our focus will now turn to the production of these items and how to measure and define the energy efficiencies, or footprints, of competing companies in a manner consistent with congressional policies of full and open competition, maximum practicable opportunity for small business, and support for domestic industrial base.

C. MEASURING ENERGY EFFICIENCY

Measuring the energy efficiencies, or footprints, of competing companies is an area in the literature that has not received the same treatment as total ownership cost and the fully burdened cost of fuel. The factors involved in monitoring the energy efficiency of companies in the production and manufacturing of their products has not been well developed. Additional troubles exist in the availability and access to data. For the sake of comparison, the DoD can monitor and initiate actions to improve the energy efficiencies of its buildings or tents by adding insulation, by installing newer and more efficient lighting, or by improving the HVAC systems for its buildings, but it does not necessarily have access to similar information regarding contractor practices. Additionally, externalities to the production process, such as weather and location are able to play an inordinate role if proper accounting that equalizes these externalities does not occur.

1. Take the Stairs—Be More Energy Efficient, Department of Energy, Energy Information Administration, June 2000

This short article from the Department of Energy (DoE) Web site laid out some issues to consider in order to arrive at a metric for measuring energy efficiency. The article pointed out that there is not a single commonly accepted definition for what constitutes energy efficiency. According to the article, some would define energy efficiency as an increase in output for a given level of energy input, or the same output for a given decrease in energy input. The article further states that the most accepted definition for energy efficiency is actually energy “intensity.” The article then defined energy intensity as the ratio of energy consumption to some measure of demand for energy services. The article pointed out the weakness in this measurement in that this ratio cannot account for externalities, such as weather and location.

2. The Industrial Sector, DoE–Energy Information Administration, October 1999

In the chapter contents of this source, the DoE attempted to lay out a methodology to tie energy efficiency to energy intensity. The chapter pointed out that since 1980, the value of industrial output for the United States has continuously increased while the value of total energy consumed by the industrial sector has fallen. This change would seem to indicate an increase in efficiency, but it fails to take into account externalities, such as a switch to a more service-oriented economy. Such externalities may reduce the real value of any gain or decrease in efficiency measured.

The chapter then detailed data available in the Manufacturing Energy Consumption Survey (MECS), which detailed national-level data on energy-related information for the manufacturing sector. The MECS provided three measures, each differing in how treatment of off-site energy, feedstock, and byproduct energy was accounted for. The chapter then detailed the weaknesses inherent in this method because non-manufacturing factors had not been

developed. Additionally, due to the output being tied to currency, it was subject to change when the currency market fluctuated, and thus would not necessarily indicate an increase or decrease in efficiency.

3. Green Building in Government Construction Contracting, American Bar Association

In the area of evaluating the energy footprint and efficiencies of a manufacturer's facilities, the government has set the example of the codes it expects manufacturers to follow by adopting these codes for its own buildings. As of January 24, 2007, through *Executive Order 13423*, the Federal government required that new construction of government buildings meet green requirements. This policy requires that construction meet green building standards and use energy-efficient technologies in the improvements of existing buildings. The United States Green Building Counsel (USGBC), a non-governmental organization (NGO), has developed nationally accepted standards for green buildings through the Leadership in Energy and Environmental Design (LEED) certification. This certification has three levels and is based on an evaluation of five factors: (1) sustainable site development, (2) water savings, (3) energy efficiency, (4) materials selection, and (5) quality of the indoor environment. Buildings are certified if they meet the minimum requirements in each area. The USGBC can award additional credit for added performance or innovation in design. It evaluates all submissions based on documentation and not by inspection or validation. A LEED certification is available for building modifications and renovations, as well as for new construction. However, there is no legal enforcement or consequences imposed by the government for failing to meet the requirements.

As a nationally accepted standard, this rating system could be applied as evaluation criteria for awarding government contracts to potential offerors. However, many government contractors have facilities that were erected prior to this policy. To compete under the energy footprint aspect, companies can submit

for a LEED certification as new renovations are made. This may be accomplished by submitting the original building documents of the existing structure for LEED certification or submitting the building documents to new facilities they have under consideration. There are some potential drawbacks, however, because it may not be cost effective for a contractor to demolish existing buildings or renovate sections to make room for new, more efficient improvements on the off-hand chance of being awarded a contract. Another possible consideration is how the cost of the facility will be distributed to the government in cost-reimbursement contracts. While the facility may have a lower overhead than one that is not “green,” it may have a higher cost of construction, which is being levied on the government, and, thus, would represent an overall drain on the total ownership cost.

In concluding the literature review, it is apparent that measuring the energy efficiencies of competing companies is very much an area in flux. Unlike those studies that considered the total ownership cost and fully burdened cost of fuel, few studies have extensively looked at these areas and examined how to objectively identify and account for competing companies’ strengths and weaknesses.

THIS PAGE INTENTIONALLY LEFT BLANK

III. METHODOLOGY

A methodology is a systematic approach for organizing and addressing a problem. In this chapter, we describe the methodology we used to conduct an analysis of the Navy implementing lifetime energy cost, including the fully burdened cost of fuel, and energy footprints of contractors as mandatory decision factors in contract award. The literature review contributed to this analysis and formed the basis for further study. The literature review contained a survey of the available literature as it applied to the topic. Following the literature review, we examined a sampling of private and government-agency practices in order to determine their applicability to the Navy. Next, we took the SECNAV's energy criteria and defined the elements involved with the criteria. We concluded our analysis with our findings, and offered our recommendations for moving forward.

A. DEFINITION

We explored the issues involved with the implementation of the SECNAV's policy by first defining the elements of total ownership cost, the fully burdened cost of fuel, and quantifying energy efficiencies of competing companies. We then examined the definitions of the elements that comprise the different aspects of the SECNAV's policy announcement in order to highlight the issues involved in implementing the SECNAV policy.

B. CONCLUSION

Finally, the project wrapped up with our findings and recommendations for proceeding. In light of the elements involved with implementing the SECNAV's acquisition policy, the objectives for this project were as follows:

- Add a clarifying definition to the complexity of implementing the SECNAV's policy announcement,
- Produce recommendations for how to proceed with the implementation of the new acquisition policy as defined in the SECNAV's announcement, and
- Make recommendations for areas of further study.

IV. PRIVATE/PUBLIC ORGANIZATION ENERGY PRACTICES: ARBITRARY YARDSTICK VS. ENERGY MANAGEMENT PROCESS

In looking at implementing a policy or process that deals with methods, measurements, and requirements that are still in the early stage of development, such as the energy and energy-efficiency requirements of the SECNAV's new policy, it is important to conduct a survey of available information to discover if anyone else is currently addressing the issue(s), and if they are, to discover how they are addressing the issue(s) involved so that we can learn from their efforts. Energy is an issue that affects organizations that are private, as well as public and thus they present opportunities for the Navy to examine how those organizations are addressing the issue of energy for applicability to the Navy's needs.

The energy issue touches the private sector because, beyond any sense of corporate social responsibility (CSR), in the pursuit of maximizing profit, corporations are incentivized, at least theoretically, to produce their goods or services in the most efficient manner. In achieving this most efficient manner it would be expected that corporations have developed or adopted metrics and standards by which they could measure the energy efficiency of the products they produce and use, as well as measure the energy efficiency of their manufacturing process in producing those products or providing their service. If such metrics and standards have been developed, then they would serve as a starting point on which the Navy could base evaluation requirements for the new energy criteria as mandated by the SECNAV.

Further, public-sector organizations also serve as valid models for the Navy to study because they are dealing with the same policy environment that is driving the Navy to focus on energy, even if they do not duplicate the exact policy. Looking at how other public organizations respond to that policy environment can help signify the importance of various measurements in

achieving the Navy's goals and possibly provide input for the metrics necessary for the Navy to evaluate the energy criteria as directed by the SECNAV. In this chapter, we will focus on various efforts taking place in the private and public sectors to deal with energy and energy efficiency.

A. PRIVATE SECTOR

1. International Organization for Standardization (ISO)

The International Organization for Standardization (ISO) is a non-governmental organization (NGO) based in Geneva, Switzerland, that identifies standards that are required by businesses, governments, and societies. According to the ISO Web site, the scope of these standards spans the definition of state-of-the-art products, services, processes, materials and systems, as well as the definition for good conformity assessment, managerial and organizational practices (ISO, 2006). The ISO develops the standards they identify in partnership with representatives from governments and businesses that work or are involved with the sector the standard will be used in. After the standard has been developed and a period of time has been allowed for comments, the standard is then voted on by the membership of the ISO. As a result, although ISO standards are voluntary, they are widely respected by both the public and private sector due to their broad base of support and development. The ISO does not carry out certification for its standards or control those organizations who do, but it has developed "a "toolbox" of ISO standards and guides for conformity assessment—covering all aspects from supplier's declaration of conformity to third-party certification and accreditation—which is becoming a vital component of business transactions, global trade and regulatory requirements" (ISO, 2006).

According to the ISO Web site, there are over 18,000 standards that are in place today (ISO, n.d.d.). These standards are often technical documents that run the gamut from ensuring interchangeability to ensuring that the manufacturing of products is done in a safer, cleaner, and more efficient manner.

The ISO suggests that the standards form the basis for legislation by providing the technical basis in areas, such as environmental legislation, health, and safety (ISO, n.d.b). Further, the U.S. government uses ISO standards in regulatory and procurement activities by drawing upon applicable standards and adopting them as a part of the regulatory scheme or including them in contracts to better their programs and improve outcomes. Additionally, ISO standards are included in the DoD Index of Specification and Standards (DoDISS) allowing for easy reference to the applicable standard when called for (National Institute of Standards & Technology, 1993). ISO standards facilitate trade by disseminating information on technological advances and good management practices and by producing uniform practices that when adopted, ensure wide acceptance across the marketplace. The ISO, by integrating private and public sectors, strives to ensure that a broad cross section of analysis is undertaken to produce standards that are fair, provide noticeable benefit, and can be met at an economical cost (ISO, n.d.b). This is done through the promotion of an international standard while increasing competition and providing larger markets for businesses to offer their products in. The ISO website offers the following:

They [the ISO national delegations representing all economic stakeholders] agree on specifications and criteria to be applied consistently in the classification of materials, the manufacture of products and the provision of services. In this way, International Standards provide a reference framework, or a common technological language, between suppliers and their customers—which facilitates trade and the transfer of technology. (ISO, n.d.c)

As a result of broad acceptance, in many ways, the ISO standard has become the gold standard across the international market place. As demonstrated by ISO 9000, Quality Management Systems, the standards that the ISO system creates drive the market to compliance, even when not backed by regulation, through pressure brought to bear by the market place. Often companies that are not in compliance with the standard are looked at as deficient in some manner and others become hesitant to do business with them. Thus, as in other areas, the ISO is sure to be a driving force in the standards for energy

and energy efficiency that a company must meet when a standard is released. This same thought was the suggestion of many Navy acquisition executives at the Secretary of the Navy (SECNAV) Energy Efficiency Summit. At the summit, numerous references were made to the fact that the ISO was working on developing standards in the area of energy and that they could become a base upon which the Navy could rely in the development of their own standards, or the ISO standard could be incorporated fully by reference.

In fact, the ISO is expected to release ISO 50001, Management System for Energy (MSE) at the end of 2010 (Pinero, 2009, pp. 18–22). Standard 50001 is based upon the same principles found in *ISO 9000 series, Quality Management Systems*, and *ISO 14000 series, Environmental Management Systems*, standards to ensure compatibility between the three. The working-draft scope statement for 50001 states:

This standard specifies requirements for an energy management system, which enables an organization to take a systematic approach to the continual improvement of energy efficiency and energy performance. It does not itself state specific performance criteria with respect to energy. This standard applies to all organizations.” (Meffert & McKane, 2009)

The scope statement indicates that the 50001 standard will require companies to implement a management system for energy that supports the organization in meeting its goals and vision for energy. The standard will not specify specific goals or requirements but will act in accordance with the same Plan-Do-Check-Act model for continuous improvement used in ISO 9000 and 14000. The expected similarities do not end there, as shown in Table 2.

Table 2. ISO 14001 versus ISO 50001 (From: Integrated Renewable Energy, 2010)

ISO 14001	ISO 50001
DOCUMENTATION	
<ul style="list-style-type: none"> ◦ Scope ◦ Environmental baseline ◦ Environmental Key Performance Indicators (KPI) ◦ Environmental Policy ◦ Environmental Goals & Targets ◦ Environmental Manual ◦ Document Control System ◦ Record Control System 	<ul style="list-style-type: none"> ◦ Scope ◦ <i>Energy baseline</i> ◦ <i>Energy KPI</i> ◦ Energy Policy ◦ <i>Energy Goals & Targets</i> ◦ Energy Manual ◦ Document Control System ◦ Record Control System
MANAGEMENT	
<ul style="list-style-type: none"> ◦ Environmental management representative ◦ Environmental management team 	<ul style="list-style-type: none"> ◦ <i>Energy management representative</i> ◦ <i>Energy management team</i>
MANAGEMENT PLANNING	
<ul style="list-style-type: none"> ◦ Environmental data management ◦ Environmental impact profile ◦ Legal & Other Requirements ◦ Environmental Goals, Targets, Project Planning 	<ul style="list-style-type: none"> ◦ <i>Energy data management</i> ◦ <i>Energy Profile</i> ◦ Legal & Other Requirements ◦ <i>Energy Goals, Targets, Project Planning</i>
OPERATIONS	
<ul style="list-style-type: none"> ◦ Materials/Equipment Purchasing ◦ Systems design & selection ◦ Systems & Process Control ◦ Project implementation ◦ Communications, training, awareness 	<ul style="list-style-type: none"> ◦ <i>Energy Purchasing</i> ◦ Systems design & selection ◦ Systems & Process Control ◦ Project Implementation ◦ Communications, training, awareness
EVALUATION & REVIEW	
<ul style="list-style-type: none"> ◦ Monitoring ◦ Internal audits ◦ Corrective & preventive action ◦ Management reviews 	<ul style="list-style-type: none"> ◦ <i>Monitoring</i> ◦ Internal audits ◦ Corrective & preventive action ◦ Management reviews
<p>Legend:</p> <ul style="list-style-type: none"> ◦ <i>New for ISO 50001</i> ◦ <i>Parallel</i> ◦ Fully Integrated 	

ISO 50001 will focus a company's attention on the management of energy use, while allowing easy integration with the current 9000 and 14000 series standards for management systems. Designed from the beginning to employ many common elements and structures with the existing standards, it will allow for faster implementation by limiting the amount of training required to apply it. Edwin Pinero chair of the committee developing the ISO 50000 series standard explains the following. "International organizations will have access to a single harmonized standard for implementation across the organization, with a logical and consistent methodology for identifying and implementing energy efficiency improvements" (Pinero, 2009, p. 18). According to Pinero, the instruction will also meet the following objectives:

- Assist organizations in making better use of their existing energy-consuming assets
- Offer guidance on benchmarking, measuring, documenting, and reporting energy intensity improvements and their projected impact on reductions in GHG emissions
- Create transparency and facilitate communication on the management of energy resources
- Promote energy management best practices and reinforce good energy management behaviors
- Assist facilities in evaluating and prioritizing the implementation of new energy-efficient technologies
- Provide a framework for promoting energy efficiency throughout the supply chain
- Facilitate energy management improvements in the context of GHG emission reduction projects
- Allow integration with other organization management systems (environment, health, and safety) (2009, p. 19)

With the lofty objectives, as mentioned above, set for the ISO 50001 standard, when it is released, it is poised to provide an international framework designed to manage all aspects of energy from procurement to use.

2. American National Standards Institute (ANSI)

Like the ISO, the American National Standards Institute (ANSI) is an NGO dedicated to standards in conformity assessment for the U.S. market. In fact, ANSI is the U.S. representative on the ISO's board responsible for, ensuring the concerns of the public, academia, businesses, and the government agencies of the U.S. are heard in the establishment of international standards (ANSI, n.d). As listed on their website, the mission statement of ANSI is as follows: "to enhance both the global competitiveness of U.S. business and the U.S. quality of life by promoting and facilitating voluntary consensus standards and conformity assessment systems, and safeguarding their integrity" (ANSI, n.d). ANSI does not develop standards but coordinates their development and sanctions standard-developing organizations to do so. ANSI will approve those standards as long as they are developed following the procedures as outlined by ANSI. In 2000, ANSI was one of the first national standards organizations to approve an energy management standard and along with the national standards organization for Brazil, is the project chair for the ISO in the development of ISO 50001 (Energetics Incorporated, 2010). As such the energy standard that ANSI approved, *ANSI Management System for Energy 2000:2008 (ANSI/MSE 2000:2008)*, is expected to be similar in nature, if not the basis, of ISO 50001. The Georgia Tech Energy and Environmental Center (GTEEC) is the organization that developed the energy standard for ANSI. Figure 4 illustrates the Plan-Do-Check-Act process improvement employed in the *ANSI/MSE* standard, the same continuous improvement process used in the ISO standards.



The Management System for Energy (ANSI/MSE 2000-2008) is based on the continual improvement Plan Do Check Act (PDCA) process. This cyclic process ensures that the management and technical elements are sustained and that improvements are verified.

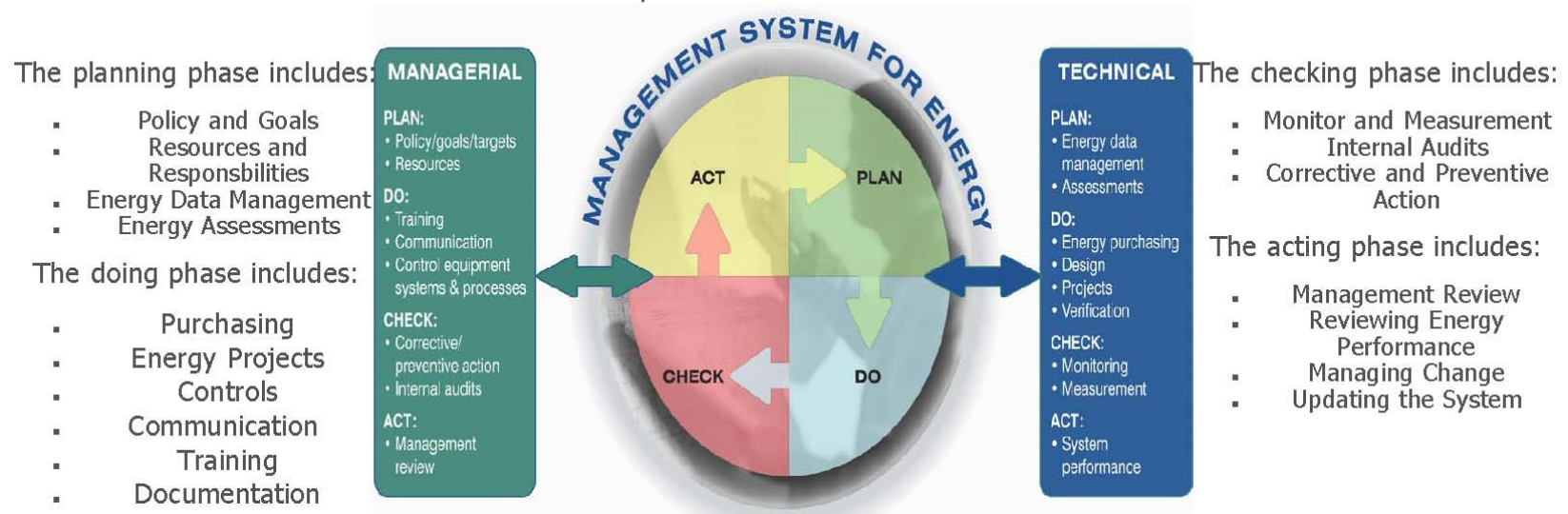


Figure 4. Plan-Do-Check-Act Model (From: GTEEC, 2007b)

ANSI/MSE 2000:2008, like the expected ISO 50001, entails a voluntary program to help companies' to reach the goals they set for energy use, management, and procurement. The *ANSI/MSE* standard recognizes both a technical and managerial aspect in driving and sustaining the energy goals of a company through a systematic process, which is flexible enough to be used across all organizations regardless of size, and fosters continual improvement in results (GTEEC, 2007a). As the GTEEC explains: "Implementation of the *Management System for Energy (ANSI/MSE 2000:2008)* contains the elements required to ensure continual improvement, sustain savings from energy projects and lead to a strategic energy management plan" (GTEEC, 2007a). The *ANSI/MSE* standard makes possible true energy management as a strategy by bringing to businesses a management focus and data combined with decision processes in order to produce results that will drive savings and provide market opportunities.

3. Wal-Mart

Wal-Mart, the world's largest retailer, has adopted many policies and practices to deal with energy and energy efficiency as part of what it calls sustainability. According to Wal-Mart, sustainability is "minimizing waste, increasing efficiency and finding ways to support the communities and suppliers that make our business successful" (Wal-Mart, 2010). Wal-Mart places sustainability in both a social and environmental context and utilizes an approach it calls Sustainability 360 to address concerns in these areas in all facets of its business.

Wal-Mart launched its sustainability programs in 2005 with three overarching goals to guide its efforts. Wal-Mart has continued with these goals today:

- Be supplied 100% by renewable energy;
- Create zero waste; and
- Sell products that sustain people and the environment. (Wal-Mart, 2010)

Under these overarching goals, Wal-Mart has 38 interim goals to drive their efforts towards achievement. In order to achieve these goals, Wal-Mart is looking beyond efforts that are completely internal to their company and is looking to affect the processes of its suppliers, vendors, and merchandisers as well—something Wal-Mart's size allows it to do. In their *Global Sustainability Report*, Wal-Mart explains the reason for their efforts as:

Because the Wal-Mart supply system is many times larger than the company's direct footprint, in many cases the biggest, fastest and most economical GHG (green house gas) reduction are not at the retail-level, but rather up or down the value-chain of consumer products, in raw material extraction, product manufacturing, transportation, customer use, or product end-of-life. (Wal-Mart, 2010, Global Sustainability Report)

Accordingly, Wal-Mart is focusing its sustainability goals to address its whole supply chain. As part of that focus, Wal-Mart is developing two programs specifically to address its suppliers: the Supplier Energy Efficiency Project (SEEP) and the Sustainability Index. SEEP is a program developed from Wal-Mart's own internal energy-efficiency program in which its engineers will go into an organization and perform an energy audit (Herrera, 2010). Wal-Mart offers the program outside of its suppliers as well, and at least 19 state governments are taking advantage of the program in their capitols (Wal-Mart, n.d.a). During the audit, the engineers identify areas for improvement that are designed to save electricity and money. Typically, the areas engineers identify are in lighting, HVAC, building envelope, and building controls (Herrera, 2010).

The Sustainability Index is a much more complex effort, designed to bring transparency across the supply chain into the social and ecological aspects that bring a product to a stores shelves. For this effort, Wal-Mart is a founding

member of the Sustainability Consortium, which is lead by the University of Arkansas and Arizona State University (Arnseth, 2009). According to Wal-Mart's *Global Sustainability Report*, the consortium is made up of an independent group of scientist and engineers from academic research institutions that are interacting with government scientist and other researchers from other retailers and the NGO community to develop and maintain a global database of information on product lifecycles from raw material to disposal (Wal-Mart, 2010). The data from the consortium will act as the basis for a consumer-facing index tool, designed to allow consumers to see a numerical rating of a product's sustainability. The development of the index tool is occurring in three stages:





1. **Supplier Sustainability Assessment.** As part of this step, Wal-Mart has already sent out a survey to 100,000 global suppliers. "The survey is not mandatory, but is designed to help suppliers evaluate their own sustainability efforts in four areas: energy and climate, natural resources, material efficiency, and people and community" (Arnseth, 2009). Figure 5 contains the questions that were asked in the survey.
2. **Lifecycle Analysis Database.** This stage is being developed by the consortium and will track information on a product's lifecycle to allow for an analysis on a products true environment, energy, and social impact.
3. **A Simple Tool for Customers.** The final step of the index will be the translation of the information developed in step 2 to a tool or number by which the customer can understand the sustainability impact of the product that they are purchasing. The format of the tool is still in development (Wal-Mart, n.d.b).

In explaining further how the index will be formed and what role the consortium will play, Dr. Kevin Dooley of Arizona State University, states in *Inside Supply Management*:

There are two components to a sustainability index—the data, and then the algorithms used to calculate a final score. To be accepted, we believe that any index must use data that are scientifically valid and transparent in their sources and their level of uncertainty—and this is the role the consortium intends to play within any indexing scheme. [...]The actual calculation of a final score or certification based on these data involves human judgment; thus, it is not a scientific task, but a business tasks. It is our hope that a broad

coalition of retailers and manufacturers will see the value in a unified effort to define how such scores are calculated and how they're communicated to consumers, and we will work toward that goal. (as cited in Arnseth, 2009)

Sustainability Supplier Assessment Questions

<p>Energy and Climate <i>Reduce energy costs and greenhouse gas emissions</i></p> 	<ul style="list-style-type: none"> 1. Have you measured and taken steps to reduce your corporate greenhouse gas emissions (Y/N) 2. Have you opted to report your greenhouse gas emissions and climate change strategy to the Carbon Disclosure Project (CDP)? (Y/N) 3. What are your total annual greenhouse gas emissions in the most recent year measured? (Enter total metric tons CO₂e, e.g. CDP 2009 Questionnaire, Questions 7-11, Scope 1 and 2 emissions) 4. Have you set publicly available greenhouse gas reduction targets? If yes, what are those targets? (Enter total metric tons and target date, e.g. CDP 2009 Questionnaire, Question 23)
<p>Material Efficiency <i>Reduce waste and enhance quality</i></p> 	<ul style="list-style-type: none"> Scores will be automatically calculated based on participation in the Packaging Scorecard in addition to the following: 5. If measured, please report total amount of solid waste generated from the facilities that produce your product(s) for Walmart for the most recent year measured. (Enter total lbs) 6. Have you set publicly available solid waste reduction targets? If yes, what are those targets? (Enter total lbs and target date) 7. If measured, please report total water use from the facilities that produce your product(s) for Walmart for the most recent year measured. (Enter total gallons) 8. Have you set publicly available water use reduction targets? If yes, what are those targets? (Enter total gallons and target date)
<p>Nature and Resources <i>High quality, responsibly sourced raw materials</i></p> 	<ul style="list-style-type: none"> 9. Have you established publicly available sustainability purchasing guidelines for your direct suppliers that address issues such as environmental compliance, employment practices, and product/ingredient safety? (Y/N) 10. Have you obtained 3rd party certifications for any of the products that you sell to Walmart? If so, from the list of certifications below, please select those for which any of your products are, or utilize materials that are, currently certified.
<p>People and Community <i>Vibrant, productive workplaces and communities</i></p> 	<ul style="list-style-type: none"> 11. Do you know the location of 100% of the facilities that produce your product(s)? (Y/N) 12. Before beginning a business relationship with a manufacturing facility, do you evaluate their quality of production and capacity for production? (Y/N) 13. Do you have a process for managing social compliance at the manufacturing level? (Y/N) 14. Do you work with your supply base to resolve issues found during social compliance evaluations and also document specific corrections and improvements? (Y/N) 15. Do you invest in community development activities in the markets you source from and/or operate within? (Y/N)

Pg 4

Figure 5. 15 Questions for Suppliers (From: Walmart, 2009)

Consequently, Wal-Mart is working through the Sustainability Index to drive energy efficiency across its suppliers not only from an internal sourcing perspective but also from the perspective of competition from the consumers who

shop at Wal-Mart. The publication of an index number, a tool, will provide the transparency necessary for merchants and consumers to make decisions based on information in conformance with the values that each holds. Wal-Mart intends that these actions taken together will drive efficiencies from suppliers in competition for business through product innovation. This innovation should then lead to greater efficiencies, creating greater value across the marketplace and for Wal-Mart (Herrera, 2010). All of which should then create the business case for Wal-Mart to continue with its sustainability programs.

B. PUBLIC SECTOR

1. Laws, Executive Orders and Regulations

The policy environment, as driven by Congress and the President, establishes the roadmap or direction in which agencies must pursue action. By defining public policy goals in laws and executive orders, Congress and the President set the destination for which agencies need to steer, through policies. The SECNAV's announcement on energy and energy-efficiency requirements for the Navy is an example of an agency pursuing the course as intended by the President, with the exact directions yet to be laid out. What follows is a sampling of the road signs, in the form of laws, executive orders, and one memorandum of understanding (MOU) that have been laid out for federal agencies to follow with regard to energy policy:

- Public Law 107—171: Farm Security and Rural Investment Act (FSRIA) of 2002
- Public Law 109—58: Energy Policy Act of 2005
- Public Law 110—140: Energy Security and Independence Act (ESIA) of 2007
- Public Law 111—5: American Recovery and Reinvestment Act (ARRA) of 2009
- Public Law 110—417: FY 2009 National Defense Authorization Act
- Public Law 111—84: FY 2010 National Defense Authorization Act:

- Executive Order 13423 Strengthening Federal Environmental, Energy, and Transportation Management, 72 Fed. Reg. 3919
- Executive Order 13514 Federal Leadership in Environmental, Energy, and Economic Performance, 74 Fed. Reg. 52117
- Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding

In addition to the sampling of laws above, the *FAR* lays out several areas in which energy needs to be considered with *FAR* Part 23—Environment, Energy, and Water Efficiency, Renewable Energy Technologies, Occupational Safety, and Drug Free Workforce—being the main thrust for conservation and efficiencies efforts in the *FAR*. The *FAR* also discusses energy as a part of the acquisition planning process in *FAR* Part 7 to ensure that all objectives of the acquisition are thought out in a balanced and complete manner. This approach has the best chance of consistently producing acquisition successes in meeting all program objectives and all sourcing requirements.

In our examination of the policy environment that federal agencies are acting in, it has become clear to us that past and current authorities have called for agencies to pursue more efficient and cleaner energy use, what some call green procurement. Here, we will examine some of the actions that the different agencies are taking. We will organize non-DoD and DoD agencies together in order to look at the policies those groups have put in place to meet the requirements placed on them by Congress and the President.

2. Non-DoD Agencies

While most of the non-DoD agencies of the federal government are unlikely to be affected by a metric for a fully burdened cost of fuel that is due to the location and manner in which they operate their equipment, they do have numerous responsibilities under the laws and executive orders in existence to increase the energy efficiency in which they operate and the energy efficiency of the equipment they buy. Numerous agencies have policy memorandums or letters laying out agency procedures for complying with laws, regulations, and

executive orders that are designed to drive energy-efficient practices and policies. However, the lead agencies for this effort tend to be the Department of Energy and the Environmental Protection Agency, both of which have substantial obligations under the law to provide energy guidance and consulting for the federal government as a whole. In this chapter, we will look at the energy policies and practices of those two organizations.

a. *Department of Energy (DoE)*

The Federal Energy Management Program (FEMP) is a program run by the DoE. FEMP is designed to provide a host of services to support an effective energy program for all agencies of the federal government. “The Federal Energy Management Program (FEMP) facilitates the Federal government's implementation of sound, cost-effective energy management and investment practices to enhance the nation's energy security and environmental stewardship” (DoE, 2009a). FEMP provides energy-efficiency consulting services to guide federal agencies in complying with the legislative and regulatory requirements placed on them; offers assistance in building and operating energy-efficient buildings; produces and publishes product guidelines and specifications for energy consumption; provides assistance in identifying sources of renewable-energy technology to meet an agency's power needs; provides guidance on fleet management and implementation of alternative fueled vehicles; provides assistance in identifying and obtaining energy-project financing and contracting; and offers training in the implementation of a complete energy program from procurement to use (DoE, 2010).

In short, the DoE's effort in the energy area is to ensure that a total management focus is taken both internally and externally. This focus spans the three main areas of: (1) energy management at federal facilities, (2) energy management at the DoE, and (3) fleet and transportation management (DoE, 2009a).

b. Environmental Protection Agency (EPA)

The EPA is the administrator of the Energy Star program, Comprehensive Procurement Guidelines (CPG), and Environmentally Preferred Purchasing (EPP) programs. Energy Star is a designation given to energy efficient products that meet the following criteria:

- Product categories must contribute significant energy savings nationwide
- Qualified products must deliver the features and performance demanded by consumers, in addition to increased energy efficiency
- If the qualified product costs more than a conventional, less-efficient counterpart, purchasers must recover their investment in increased energy efficiency through utility-bill savings, within a reasonable period of time (10 years)
- Energy efficiency can be achieved through broadly available, non-proprietary technologies offered by more than one manufacturer
- Product energy consumption and performance must be measured and verified with testing
- Labeling product packages must effectively differentiate products and be visible for purchasers (EPA, 2010b)

The CPG program designates products that can be manufactured using recovered materials. Once a product is designated for the CPG, procuring agencies are required to purchase a product containing the highest content of recovered materials (EPA, 2009). *FAR* Part 23.4 places the requirement of procuring recovered materials designated by the CPG on federal agencies. Lastly, the EPP provides green product and services information to ensure compliance with green purchasing requirements. The EPP compiles information to allow for the easy comparison of a product's green specifications while allowing for a cost-benefit analysis to take place with regard to the purchasing decision (EPA, 2010a).

3. DoD

Due to numerous reports detailing the fact that the services in the DoD undervalue the fully burdened cost of fuel as an element of the lifecycle energy cost and to the increasingly loud voice of operational commanders who are calling for weapons systems and technology that relieve the logistics burden of fueling those systems, the DoD has been pushed to take a lead in the drive for energy efficiency. As a result of the operational environment and the types of systems that the DoD employs, the DoD's drive toward energy efficiency has gone beyond the efforts that non-DoD agencies and organizations are employing, particularly in respect to the valuation issue of the fully burdened cost of fuel. The fully burdened cost of delivered energy was implemented as a mandatory element in trade-off analyses conducted for all tactical systems that consume energy in an April 10, 2007, memorandum from the Under Secretary of Defense (AT&L). Today, guidance requiring the fully burdened cost of fuel is contained in the *DoD 5000* series framework. We will now look at the actions that the Army and Air Force are employing with regard to the energy issue.

a. Army

In 2004, the Army issued *The Army Strategy for the Environment: Sustain the Mission—Secure the Future*, which established a long-range vision for the Army of sustainability. The strategy, as laid out in the document, “transitions the Army’s compliance-based environmental program to mission-oriented approach based on the principles of sustainability” (U.S. Army, 2004). The document defines sustainability from the Army perspective as being able to “meet current, as well as future mission requirements worldwide, safeguards human health, improves quality of life, and enhances the natural environment” (U.S. Army, 2004). As part of the strategy vision, the document lays out six goals, including one for minimizing impact and total ownership cost, which directs the Army’s posture toward the environment.

As a result of a new mission-based focus for the Army's environmental program, on January 7, 2009, a memo was released with the subject, *Energy Productivity in U.S. Army Weapon Systems*. This memo called for Army acquisition managers to consider energy-supply assurance, energy-demand reduction, and energy efficiency in their decision-making. One of the items in the memo called for program managers (PMs) to "ensure that the FBCF methodology is used in the estimation of the Ownership Cost Key Systems Attribute" (Office of the Assistant Secretary of the Army (AT&L), 2009). It also required PMs to "include energy productivity in source selection criteria, statements of work or performance descriptions for design and development, and procurement contracts for end items and major sub-systems" (2009). Included as an attachment to that memo was guidance on implementing the fully burdened cost of fuel in accordance with the Army-approved seven-step process. The Army's seven-step process is discussed further in Chapter IV.

On January 13, 2009, the Army updated its strategy with the release of *Army Energy Security Implementation Strategy*. This strategy called for five overarching goals for the Army with regard to energy: surety, survivability, supply, sufficiency, and sustainability (U.S. Army, 2009). The new strategy adopted the ISO 14000 series standard in order to manage its program for sustainability and established an Army-energy leadership framework centered around the newly created Army Senior Energy Council (SEC) (U.S. Army, 2009).

b. Air Force

The Air Force is the largest end-user of energy in the DoD and in the federal government (U.S. Air Force, 2010). For many years, the Air Force's primary focus in the area of energy was in the development of bio-fuels, particularly for their aircraft. The focus of the Air Force was on the diversity of its supply in order to ensure effective access. In 2010, the Air Force issued a new plan and vision for energy: "The Vision for the Air Force Energy Plan—Make Energy a Consideration in All We Do—highlights that energy is central to all of

the interdependent functional aspects of the Air Force's mission execution" (U.S. Air Force, 2010). This new plan recognizes the central role that energy serves in enabling the Air Force to fulfill its mission, and it recognizes the constant assessment that is needed to ensure that objectives are being met and are still valid. As the *Air Force Energy Plan 2010* explains: "Energy Management is an evolving process that will require the systematic incorporation of new information, rigorous insertion of technological advancements, and continuous improvement of process and practices" (U.S. Air Force, 2010). The Air Force identified three pillars that will guide the management of energy: reduce demand, increase supply, and change the culture. In order to ensure the integration of the three pillars, the Air Force established the Energy Senior Focus Group (SFG) as a management structure for its energy programs (U.S. Air Force, 2010).

C. CHAPTER SUMMARY/ANALYSIS

In this chapter, we looked at selected private- and public-sector practices with regard to energy and energy efficiencies. While industry is progressing on energy efficiencies, little effort is being made with regard to identifying metrics to calculate a fully burdened cost of fuel, mainly due to the uniqueness of the requirement and its almost exclusive applicability to DoD functions. In terms of the public sector, non-DoD agencies are taking advantage of similar industry practices in the areas of energy efficiencies, but again, the fully burdened fuel metric remains a DoD problem. The DoD and the services are also taking advantage of the industry experience and adopting industry practices for the management of energy; however, the services and the DoD seem to be working through issues with identifying the elements that constitute the fully burdened cost of fuel and with defining what standard produces the most beneficial results for decision-making.

In the relatively new area of energy management, standards are being developed and existing standards are being improved through the application of new technologies and metrics that measure and record benchmarks as part of a

management system for energy. The current *ANSI Management System for Energy* and the future ISO 50000 series standard entail the extensive use of a continuous feedback loop to allow constant assessment and correction of an organizations energy strategy to meet new and ever-changing goals for improvement.

These management systems for energy are becoming more widespread because of the demonstrated successes that they have already enjoyed—successes, such as the Wal-Mart sustainability effort. These management systems are successful because they are able to focus on energy-efficiency opportunities and take advantage of those opportunities to create value for the companies employing them. In other words, they are successful because they are able to demonstrate a return on investment or a business case for the companies employing them.

The DoD and the military services have taken notice of the effectiveness of having a management system for energy in place by adopting in some manner the model within each of their organizations. The same value that these management systems can create for the private sector is available to the public sector in the form of savings on energy costs. Additionally, the management systems that the DoD and the services are employing are allowing for a concerted assessment and planning of strategies to meet their targets in energy and energy-related criteria. In other words, the management systems for energy that the DoD and the services are employing are allowing them to move beyond simple compliance with existing laws and regulations and to drive toward specified energy and efficiency goals.

With regard to the SECNAV's announcement, management systems for energy shows great promise in being able to meet the SECNAV's goal to drive industry to produce the Navy's systems in a more energy-efficient manner. By encouraging a contractor or prospective contractor to adopt a system for managing energy, the system forces the contractor to take a proactive approach in the area. By taking a proactive approach to managing energy, a contractor will

likely turn up inefficiencies—many of which can be easily reduced or eliminated, thus increasing contractor profit and producing Navy systems in a more efficient manner. Additionally, encouraging a contractor to adopt a management system for energy, as called for in the ANSI and ISO standards, has the added bonus of removing the Navy from the cost associated with developing a unique standard and from many of the costs associated with compliance with a new standard, while also maintaining the objectiveness that comes with the widespread adoption of industry standards in the commercial marketplace.

THIS PAGE INTENTIONALLY LEFT BLANK

V. PROBLEM DEFINITION

In review of acquisition policy, we identify opportunities and weaknesses in the current policy. The problem definition will be enhanced by establishing a basis of comparison between existing acquisition policy and new amendments to that policy. The addition of enhanced energy evaluation factors will present some similarities, differences, and challenges brought on by new policy directed by the SECNAV. In his address to the Naval Energy Forum in October 2009, the SECNAV introduced lifecycle energy cost as a mandatory evaluation factor in the acquisition process. This includes the fully burdened cost of fuel, as well as the overall energy efficiency and energy footprint of competing contractors and holds them contractually accountable (Mabus, 2009). We will analyze the energy-related concepts and definitions contained in existing policy for compatibility with the goals and objectives the SECNAV aims to achieve. We will use these comparisons to identify potential challenges that acquisition agencies will need to address in future procurements. We will begin the current policy identification with definitions of the acquisition evaluation factors related to lifetime energy cost.

A. TOTAL OWNERSHIP COST

We are going to change the way the Navy and Marine Corps awards contracts. The lifetime energy cost of a building or a system, and the fully burdened cost of fuel in powering those, will be a mandatory evaluation factor used when awarding contracts. We are going to hold industry contractually accountable for meeting energy targets and system efficiency requirements.

-Secretary of the Navy, the Honorable Ray Mabus

The term total ownership cost (TOC) is a concept used in program acquisition analysis to evaluate the magnitude and scope of costs associated with a program. The relevance of TOC with respect to the SECNAV's goals and policy is its inclusion of lifecycle costs. Lifecycle costs include many direct and indirect cost elements, elements in which energy and fuel are included.

The concept of TOC is broadly defined by the *Defense Acquisition Guidebook (DAG)* as the inclusion of lifecycle cost elements, as well as other indirect costs associated with infrastructure or business process costs not normally attributed to the program. It reaches beyond the direct and indirect costs associated with lifecycle costs to include broader support and infrastructure activities, such as recruiting, accession training, and contract oversight by the Defense Contract Management Agency (DCMA). The concept of TOC is used to consolidate direct and indirect costs that are attributed to a program and its operation (DAU, 2010). This concept is fundamental to understanding how lifecycle energy costs contribute to TOC. It should also be noted that the largest components of TOC are personnel, operations, and maintenance, which can account for 70–80% of the total lifecycle cost of a program (Fein, 2010).

The concept of TOC is not defined or described in the Federal Acquisition Regulation (FAR), the Defense Federal Acquisition Regulation Supplement (DFARS) or the Navy Marine Corps Acquisition Regulation Supplement (NMCARS). However, lifecycle cost is used in the FAR and DFARS and is closely related to TOC, yet there is no use of lifecycle cost in the NMCARS. The difference between TOC and lifecycle cost is breadth of scope. The scope of lifecycle cost is not as broad as the scope used in TOC.

Life-cycle cost includes all costs that are logically attributed to a program. It includes all direct and indirect costs and is summarized into four categories: research and development, investment, operating and support, and disposal. The majority of energy and fuel costs fall into the operating and support category. Figure 6 shows how significantly that operating and support costs impact the total lifecycle cost of a program (DAU, 2010). This figure can also be used to illustrate

the initial acquisition cost, which is comprised of research, and development, as well as the investment cost. Since the majority of costs are assumed in the operations and support phase rather than the initial phases of acquisition, it would seem logical to evaluate a system based on the expectation and inclusion of operations and support costs rather than just on the initial acquisition costs, which is where program managers tend to focus. Thus, this distribution of a program's costs is the logic behind analyzing lifecycle energy costs that compose lifecycle cost.

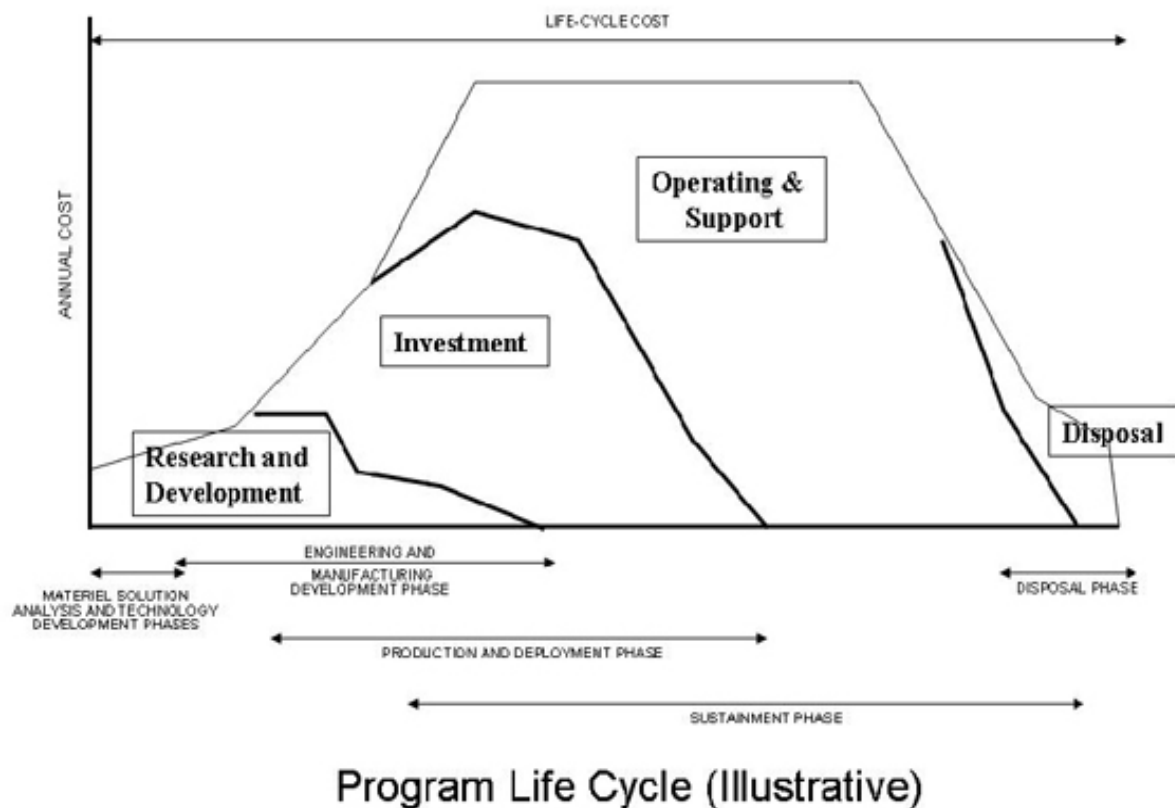


Figure 6. Notional Profile of Annual Program Expenditures by Cost Category over the System Lifecycle

In a 2008 article on the Air Force's competition for a new tanker aircraft, John Young, Under Secretary of Defense for Acquisition, Technology, and Logistics claimed that lifecycle costs are too difficult to accurately assess because of fluctuations in areas outside the Pentagon's control. An example he

gave was the recent price fluctuation of oil, which had dropped significantly and reduced the lifecycle costs of competing tanker aircraft. The fuel efficiencies of the two aircraft were different and given the challenge of predicting costs in the future, the easiest way to conduct a price competition was through the initial acquisition cost of developing and purchasing the first model (Butler, 2008). This is an approach that other programs across the services take. This approach is an example that counters the concept and application of using lifecycle costs and TOC. An approach, such as this ignores many of the costs (i.e., operations and maintenance) incurred beyond the acquisition of the first item, which would be included in the composition of lifecycle cost.

Part of the problem in systems acquisition, such as the Air Force's approach on lifecycle costs for its new tanker aircraft, is the lack of policy to sufficiently guide acquisition professionals in the use of lifecycle cost. The lack of policy is analogous to the SECNAV's goals and policy on lifecycle energy costs. For instance, one drawback with respect to the SECNAV's goals and policy is that the *FAR*, *DFARS*, *NMCARS*, and *DAG* do not give a specific definition for lifecycle energy cost. Energy and its encompassing components, such as fuel and electricity are grouped as cost elements under the operations and support category. However, it is unclear if those costs are at the commodity prices or the fully burdened price. The *DAG* provides a separate explanation for when the fully burdened cost of delivered energy should be applied in the acquisition cycle, but there is no correlation or guidance that clearly relates the fully burdened cost of delivered energy to lifecycle cost, lifecycle energy cost, or to whether it should be accounted for in the operations and support category of total lifecycle costs (DAU, 2010).

A connection between lifecycle energy costs and the fully burdened cost of delivered energy is apparent, but not clearly defined or associated. A parallel may also be drawn between lifecycle costs and lifecycle energy costs. If the same estimation and analysis that is applied to life cycle cost is applied to life cycle energy cost, then the concept of lifecycle energy cost may be interpolated.

Otherwise, the term and concept is undefined and, therefore, needs clarification to meet the SECNAV's energy evaluation requirements. Additionally, if lifecycle energy cost falls under the presumed connection with lifecycle cost, then they will have a direct impact on TOC.

The *DAG* also provides four different methods and/or models to estimate costs for a weapons system (DAU, 2010). The method or model is chosen based on the suitability of available data and on the maturity of the program. Most estimates are derived from a combination of the following estimation techniques:

- Parametric. This method uses regression or statistical analysis to develop cost-estimating relationships. A cost-estimating relationship of the desired cost element is derived from one or more independent variables.
- Analogy. This method uses historical data to estimate costs for an analogous system. A currently fielded system is used to draw similar costs to the desired cost element of the system under consideration.
- Engineering Estimate. The use of engineering estimates requires extensive knowledge of a system and its characteristics coupled with ample amounts of detailed data. The components of a system are broken down into individual elements and costs are determined separately. They are then aggregated to form a total cost.
- Actual Costs. This method uses actual costs experienced or trends from similar systems. Cost estimates that support a full-rate production milestone decision should be based on actual cost data to the greatest extent possible.

These models/methods can also be used to understand the costs associated with lifecycle energy costs. However, with any model or method, the results are reflective of the inputs. One of the challenges with estimating lifecycle energy costs is deciding which factors to incorporate into the estimation for a system that may last decades into the future. The volatility of fuel prices is one example. If competing systems operate on the same fuel, then the market volatility will affect them both equally and therefore make the market volatility negligible. However, in evaluating the lifecycle energy costs of different sources of fuel for competing systems, the market volatility of one fuel may not be

reflective of the other because the market could affect them differently (e.g., gasoline compared to biofuel). Plus, there are no certain indicators of what each type of fuel will experience over the lifecycle of a system. Thus, a lifecycle analysis on competing fuel sources is difficult to ascertain and to attribute the proper amount of fairness as an evaluation factor.

The *Operation of the Defense Acquisition System, DoD Instruction 5000.02*, does not provide a definition for lifecycle energy costs. It does state that during the analysis of alternatives in the Material Solution Analysis phase, energy-efficient solutions consistent with cost effectiveness and mission requirements should be assessed. It also states that the fully burdened cost of delivered energy should be used in trade-off analyses for all DoD tactical systems with end-items that create a demand for energy (USD(AT&L), 2008, p. 59).

In order to deliver actionable items that meet the SECNAV's goals, the definition of lifecycle energy costs should be listed in the policy and guidance used by Navy acquisition agencies and professionals. The Office of the Assistant Secretary of the Navy for Acquisition and Logistics Management is in the process of drafting guidance that accomplishes this objective. This guidance will more clearly delineate the terms and procedures to correspond with the SECNAV's energy goals and policy. This new policy should, therefore, be made available for public comment and the input of industry. The vetted product should then be reflected as a change to the NMCARS so that it may be binding to industry when competing for business with the Navy and Marine Corps.

1. Fully Burdened Cost of Fuel (FBCF)

The term "fully burdened cost of fuel" (FBCF) merits discussion because it is a component of TOC and because of its recent popularity in understanding fuel costs on the battlefield. As an example, in the SECNAV's October address to the Navy Energy Forum he quoted USMC Commandant General Conway as stating that there are places on the battlefield where it costs up to \$400 per gallon to

deliver fuel (Mabus, 2009). These costs have brought awareness to Congress and senior leadership within the military about the way tactical operations are conducted and supported.

Historically, the evaluation process in defense acquisition has typically considered the commodity price as the only lifecycle cost of fuel determinant. Using only the commodity price of fuel disregards the necessary costs of transporting, storing, and protection to the point of use. The supporting infrastructure and manpower assets necessary to provide fuel are cost contributors that should also be evaluated and included in the analysis of costs (Corley, 2009).

For the purposes of continuity in terms, Defense Department guidance refers to FBCF as the Fully Burdened Cost of Delivered Energy (FBCE). The *Operation of the Defense Acquisition System, DoD Instruction 5000.02*, states very succinctly that the FBCE should be used in trade-off analyses for all DoD tactical systems with end-items that create a demand for energy (USD(AT&L), 2008, p. 59).

The *DAG* furthers the explanation of this concept. The *DAG* states that the inefficient use of fuel or energy in tactical systems has vulnerabilities that are often unrecognized. Those vulnerabilities include a greater demand of energy and, therefore, greater dependence on logistics forces. Furthermore, inefficiencies in fuel consumption impose limitations on operational flexibility by demanding greater support and replenishment. The limits of the support and replenishment capabilities and systems providing them will further limit the operational flexibility. The *DAG* also states that one reason for not recognizing the vulnerability of energy demands is the acquisition process undervalues the benefits of technologies that can reduce energy demands in deployed systems. Thus, the FBCE was created to give more importance to energy use on the battlefield so that it might be applied to trade-off analyses in the acquisition process. Accordingly, this should be included in the Analysis of Alternatives conducted during the Material Solution Analysis phase of the Defense Acquisition

Lifecycle Management System. The FBCE should also be added to the total ownership cost (TOC) estimates used in system design and technology trades (DAU, 2010).

The *National Defense Authorization Act of FY 2009* defines the fully burdened cost of fuel as “the commodity price for fuel plus the costs of all assets and personnel required to transport and, when necessary, provide security from the receiving point to the point at which it will be consumed” (U.S. House, 2008).

The 2010 *Quadrennial Defense Review (QDR)* also acknowledges the potential benefits to improving warfighting effectiveness that may result from pursuing greater energy efficiency and corresponding technologies. It does so by including a section that reinforces the *National Defense Authorization Act of 2009*. The report also further contributes to the pursuit of these goals by designating a fund that is used for innovation toward improving operational energy concepts. The *QDR* states,

Energy efficiency can serve as a force multiplier, because it increases the range and endurance of forces in the field and can reduce the number of combat forces diverted to protect energy supply lines, which are vulnerable to both asymmetric and conventional attacks and disruptions. DoD must incorporate geostrategic and operational energy considerations into force planning, requirements development, and acquisition processes. To address these challenges, DoD will fully implement the statutory requirement for the energy efficiency Key Performance Parameter and fully burdened cost of fuel set forth in the 2009 National Defense Authorization Act. The Department will also investigate alternative concepts for improving operational energy use, including the creation of an innovation fund administered by the new Director of Operational Energy to enable components to compete for funding on projects that advance integrated energy solutions. (DoD, 2010, p. 87)

One of the potential problems in the transition to alternative fuel sources is not moving from one type of fuel to another more efficient type. The problem exists in creating another needed fuel to operate in a combat area and, thus, having multiple fuel sources required to operate equipment in a transformation

phase for alternative energy. While some new systems require less fuel and others may be created that operate on alternative fuel, the infrastructure and footprint needed may actually increase. So, instead of transporting and storing diesel fuel, gasoline, and aviation fuel, alternative fuel may now add to the array of fuels needed to optimally operate systems in combat. Creating a larger fuel footprint in order to store and manage more fuels increases the vulnerability for commanders by increasing the diversity and the corresponding size of the logistics tail. So, part of the solution is not to add new types of fuel to operational environments, but to fully replace conventional fuels in combat areas with more energy-efficient fuels that induce a smaller logistics tail. In accordance with FAR Par 7 (2009), this analysis should be applied to the acquisition planning stage of system procurement. Reviewing these potential impacts in the acquisition planning phase will help determine if the required system will meet the warfighter's effectiveness while achieving the desired energy related goals and reductions in vulnerability.

These policies clearly recognize the apparent significance and importance that FBCF/FBCE can play in the acquisition of systems but fail to provide clarity on a uniform composition of elements that should comprise FBCF/FBCE. The poorly defined elements necessary to capture the essence of the concept leave room for interpretation. In conjunction, the data necessary to capture the essence of the concept is nebulous too.

A supplement to the *DAG*, titled *Fully Burdened Cost of Delivered Energy- - Methodological Guidance for Analyses of Alternatives and Acquisition Tradespace Analysis*, provides an interim solution to the clarity of FBCF/FBCE elements. This guidance provides an interim guideline for calculating FBCF while a fully developed determination is in progress. The interim guidance outlines a 7-step method to estimate FBCF. The planning steps in this model are a method that is dependent on a given scenario. While it is broad guidance for determining burdened costs, the steps should be tailored for selected supply chains, systems, or platforms within a given scenario (DAU, 2010).

Fully Burdened Cost of Delivered Energy - 7 steps to estimating cost elements

Step	Element	Burden Description
1	Commodity Cost of Fuel	DESC standard price for the appropriate type or types of fuel
2	Primary Fuel Delivery Asset O&S Cost*	Cost of operating service-owned fuel delivery assets including the cost of military and civilian personnel dedicated to the fuel mission.
3	Depreciation Cost of Primary Fuel Delivery Assets*	Measures the decline in value of fuel delivery assets with finite service lives using straight-line depreciation over total service life
4	Direct Fuel Infrastructure O&S and Recapitalization Cost*	Cost of fuel infrastructure that is not operated by DESC and directly tied to energy delivery
5	Indirect Fuel Infrastructure*	Cost of base infrastructure that is shared proportionally among all base tenants
6	Environmental Cost*	Cost representing carbon trading credit prices, hazardous waste control and related subjects.
7	Other Service & Platform Delivery Specific Costs*	Includes potential cost associated with delivering fuel such as convoy escort, force protection, regulatory compliance, contracting and other costs as appropriate.

* These costs vary by Service and delivery method (ground, sea, air)

Note: DESC is Defense Energy Support Center

Figure 7. OUSD (AT&L)–Defined Cost Elements for FBCF

In a thesis by Robert Corley (2009), the 7–step method was tested with an application of cost data associated with a DDG-51 class surface combatant. His results add more validity to the 7–step method and support its utility in cost analysis. The results of his analysis provide three key observations:

1. Even with the expected fluctuations of commodity fuel prices in the future, burdens associated with infrastructure, manpower, force protection and security will still have a significant proportion of the total cost burdens.
2. The fully burdened cost to purchase, transport, store and protect fuel and its logistics tail can be many times greater than the commodity price of fuel alone.
3. With a conservative value assigned to cost element 7 in the model, the resulting increase in fuel cost per gallon was not inconsequential. In fact, when multiplied over the lifecycle of the platform it amounted to several billions of dollars (Corley, 2009).

Corley's analysis validates the utility of assessing FBCF and using it early in the acquisition process. Used correctly, this analysis can potentially conserve defense funding or channel the funding more effectively into other resources required to operate in the nation's interest.

B. ENERGY EFFICIENCY AND FOOTPRINTS OF COMPETING COMPANIES

We will also use the overall energy efficiency and the energy footprint of a competing company as an additional factor in acquisition decisions.

-Secretary of the Navy, the Honorable Ray Mabus

The SECNAV's announcement about evaluating energy efficiency and the energy footprint of competing companies is a way to influence companies that do business with the Navy to conform to the Navy's values on energy efficiency. It could potentially steer companies toward a more conscious awareness of their impact on the environment and the sources of energy they use. Prior to the SECNAV's announcement, contractors were not evaluated on the energy efficiency of their facilities. If a contractor wanted to be more energy efficient, then the company could invest capital to do so. A decision to do so could possibly result in improved profit margins or in enabling the contractor to place more competitive bids on contracts. However, this announcement marks a turning point in which the energy efficiency and energy footprint will be required as mandatory evaluation factors in the source selection of an item. Therefore, the SECNAV's announcement provokes a greater incentive to make investments in energy-efficient improvements.

Deciding among competitors could become difficult when comparing more than one contractor that has energy efficient measures in place. Some method of evaluating the difference in energy efficiency between competitors will need to be developed for use in the acquisition decision process. Then again, how much weight should be given in an acquisition decision for contractor facilities when the

ultimate objective is to acquire a system or platform that meets a defined requirement? In order to give these energy characteristics a viable influence in acquisition decisions some amount of relative weighting and/or an associated value assigned to the outcome will need to be developed and translated into an assessment criteria. This is one of the challenges with incorporating the energy efficiency and energy footprint of a company as a mandatory evaluation factor. Having little guidance or leadership to account for the value and resulting weight in an acquisition decisions especially with respect to other evaluation factors will make decisions based on companies' energy profile difficult. Furthermore, without having a value assigned to a company's energy efficiency, it is possible this evaluation factor will get downplayed by criteria that are more directly tied to the actual requirement.

An established standard by which to compare different contractors will provide fairness and consistency in evaluation. Currently, the U.S. Green Building Council uses a Leadership in Energy and Environmental Design (LEED) Green Building Rating System to assess buildings. This assessment promotes a whole-building approach to sustainability. It accomplishes this by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality (USGBC, 2010). A second standard that is being developed is the ISO 50000 series certification mentioned in Chapter IV. This could be an additional way to use a developed criteria based on a uniform set of standards. These standards could then be utilized as an objective means of achieving a standard criterion for evaluation among competing companies.

VI. CONCLUSION

The SECNAV's announcement on energy and energy-related criteria places the Navy in the position of not merely being in compliance with existing laws and regulations but of truly driving goals and expectations in new ways in order to position the energy question as a strategic issue. The two main policy drivers pushing the energy issue to the forefront are as follows:

- A warfighter's requirement—The increasingly complex weapons systems the Navy is procuring, developing, and using require more and more energy to operate and, thus, more logistics support. This logistics support reduces combat power by requiring combat assets for security and increases vulnerability due to increased convoys and greater risk from an enemy that would seek to deny access.
- Budgetary need—Increasing pressure is being placed on the DoD budget and, thus, on the Navy's as well. With the Navy currently not able to meet the stated requirement of 313 ships due to funding constraints, pressure is increasing to find areas for savings in order to allow the Navy to maintain the fleet it has and to build the fleet it needs (Rutherford, 2010). In looking at the cost structure of a weapon system, the majority of its cost occurs during the operations and support phase of a weapons system's life, and yet the area in which cost is substantially locked-in is in the development phase at the Critical Design Review (CDR). Thus, any effort to drive savings in a weapon system needs to occur or concentrate on the acquisition phase. The budgetary point is driven home by the following news article headlines: U.S. House Seapower Chair Wants Ship-Retirement Limits; Gates: U.S. Must Rethink Expensive Warships, Carriers, EFV; and Gates Seeks Pentagon Overhaul: Wants to Cut Costs of Weapons, Health Care, Administration.

In applying the SECNAV's energy criteria to acquisitions, the Navy has an opportunity to ensure that energy both as an operational requirement and financial cost driver is properly valued in making key decisions regarding acquisition programs and development. However, of primary importance when applying the SECNAV's energy criteria is fulfilling the warfighters' requirements, delivering a system that meets the needs as stated in the requirements document remains the primary goal for acquisition decisions to meet. Navy

acquisition officials operating with an understanding that energy efficiency can serve as a combat multiplier and an investment to future savings, can lead to distinctions between bids, and, with the proper weight given to energy criteria, can lead the Navy to make the best acquisition decisions for its programs.

In light of the SECNAV's direction on energy and energy-related criteria and in light of the need for the Navy to produce criteria that are objective, provide meaningful analysis, withstand legal challenges, offer meaningful performance advantages, produce cost savings, and fulfill warfighter's requirements, our findings are presented below.

A. FINDINGS

In light of our research, we offer the following as our findings:

1. In accordance with previous reports and studies, the Navy undervalues energy both as an operational factor and as a long-term cost driver or multiplier.
2. Navy makes acquisition decisions based upon first article price rather than total ownership cost.
3. Beyond the advantages to a company of having a process or system in which to manage energy, there exists little agreement on what constitutes differing categories of energy performance.
4. Little agreement exists on the metrics and means necessary to evaluate competing companies with regard to the energy footprint they produce. A larger company may have a larger footprint and yet be more efficient than a smaller company. In the same manner, companies in differing regions will make investment decisions based upon the climate where their facilities are and yet those investment decisions may not align with the energy efficiencies of the companies. In other words, a company in Boston making extensive investments to deal with harsh winters, could, in spite of those investments, be disadvantaged versus a company in San Diego due strictly to the increased energy needed to maintain climate control in their facilities.
5. In light of the difficulty with establishing consensus for metrics and means to evaluate the energy footprint of companies (i.e., developing a Navy-wide yardstick), it is preferable to require contractors demonstrate an energy management process.

6. Warfighters are starting to recognize the importance of energy efficiency to the systems they employ on the battlefield and the consequences for having inefficient systems to the combat power they can employ.
7. Energy criteria need to be stressed by requirements generators in order to create the demand for evaluation of the criteria at the contract award phase.
8. Many of the current weapons system programs are locked into contracts, and it would be cost prohibitive to re-open those programs while under current contract.
9. The importance of the FBCE or FBCF is recognized, yet disagreement persists as to how far out the elements that produce those numbers go.
10. International standards with regard to energy management are being produced and employed. Leading companies, such as Wal-Mart are among those highlighting best practices in attempting to drive energy efficiencies and generate savings.
11. Disagreement persists in how long out the Navy should be looking to generate a positive net present value when making energy decisions. Current executive-order guidance calls for federal agencies to make energy investments with a return on investment in 10 years.
12. A significant portion of total ownership cost is set by the final design of the system, which is determined at CDR, and, thus, serious effort to produce savings needs to look at the elements prior to reaching this point.
13. The current acquisition process contains disincentives for programs and PMs to address anything more than the initial acquisition cost to their programs.

B RECOMMENDATIONS

After concluding our research, we recommend the following actions:

1. In governing new Navy requirements, contractors put in place an energy management process rather than submit to an arbitrary energy footprint or efficiency standard.
2. Draft an amendment to the Navy and Marine Corps Acquisition Regulations governing the new energy requirements. Justifications and recommended proposal are included below in section C.

3. Requirements generators and acquisition personnel should be brought together to drive home and vet energy perspectives from both points of view and to create a balanced policy for implementation.
4. Within each program office, a senior position should be created for an advocate of sustainability and logistics over a systems lifecycle.
5. An extensive education campaign needs to take place with regard to leadership (presidential, congressional, DoD) to educate on the difference between initial acquisition cost and total ownership cost and on the importance of total ownership cost to maintaining the fleet.
6. Total ownership cost needs to play a greater role in acquisition decisions to generate savings over the life of a system.
7. Acquisition decisions need to be made with a long-term perspective. Total ownership cost needs to be evaluated using a net present value system in all system acquisitions. In order to evaluate whether an initial investment in the energy efficiency of a weapons system brings the proper return on that investment, total ownership cost needs to be defined by a dollar value. These return-on-investment decisions need to be made with an eye toward generating future savings in order to ensure the affordability of the fleet.
8. In judging a company's energy efficiency and footprint, given the lack of objective criteria, a company should be required to conform to an energy management system standard, such as the *ANSI/MSE 2000:2008*, which is soon to be replaced by the ISO 50000 series. By adopting standards that maintain broad private- and public-sector support, the Navy can avoid the cost of developing the standard and much of the cost of the implementation.
9. Extensive training on the new energy requirements take place in the acquisition community.

C. RECOMMENDATION FOR NAVY MARINE CORPS ACQUISITION REGULATIONS

Currently, the Navy is drafting a policy memo to implement the energy and energy efficiency requirements directed by the SECNAV. However, due to the nature of a policy memo being internal guidance our recommendation is to produce a proposal for inclusion in the Navy and Marine Corps Acquisition

Regulation Supplement (NMCARS), which would govern those seeking to do business with the Navy, as well as the internal structures and processes of the Navy. Additionally, in taking this recommendation, we propose the Navy highlight the impending energy rules through two steps:

1. The issuance of an advanced notice of public rulemaking. This step would ensure that a period of public comment and rule making be established during which the valuable input of industry, and others could be taken into consideration to drive better policy development.
2. The formation of a negotiated rulemaking committee. This step would ensure that, in the formulation of the new energy criteria, that industries concerns were addressed and incorporated into the new regulation. Additionally, it would help to ensure buy-in from industry in general by giving them a seat at the table in tailoring the new energy criteria. Also, by allowing industry participation in this process, it would ensure that any criteria did not impose an undue additional cost burden on the Navy.

Our guidance for development of this proposal is in line with our recommendations above but of primary importance was the desire to contain cost while meeting the SECNAV's directives for energy. Additionally, in considering any implementation regarding energy and energy related criteria the primary purpose and objective of Navy acquisitions is to meet the warfighter's requirements while maintaining the FAR's policy of transparency, and full and open competition. With this in mind, the following is our recommended amendment to the NMCARS.

PART 5215 CONTRACTING BY NEGOTIATION

5215.304 EVALUATION FACTORS AND SIGNIFICANT SUBFACTORS

(c)(7)(i) Except as set forth in paragraph (c)(7)(ii) of this section, energy management shall be evaluated in all source selections for negotiated competitive acquisitions expected to meet requirements to be designated an acquisition category program (ACAT) and subject to the requirements of DoD 5000.02 Operation of the Defense Acquisition System.

(ii) Energy management need not be evaluated if the contracting officer documents the reason energy management is not an appropriate evaluation factor for the acquisition or in cases designated as a rapid deployment capability.

5215.305 Proposal evaluation

(a)(6)*Energy management evaluation.* The energy management criteria is an evaluation of offeror's ability to deliver energy efficient products in an energy efficient manner. This comparative assessment evaluates an offeror's proposed weapon system or platform in terms of its total ownership cost, and the system the company has in place to manage its energy efficiency in delivering proposed weapon system or platform. For contracts for buildings see (iii) below.

(i) Total ownership cost shall include lifecycle energy cost including the fully burdened cost of fuel. In submitting estimates for the fully burdened cost of fuel (FBCF) offerors shall provide documentation of their calculation in accordance with the approved Seven-Step OSD PA&E Methodology. In submitting documentation of lifecycle energy cost the offeror shall rely upon the standards of the OSD Cost Assessment and Program Evaluation (CAPE) and DoD Cost Analysis Guidance and Procedures. The justification for this analysis is that energy efficiency in a weapon system or platform will drive total ownership cost down, thus the most efficient weapons system or platform would also have the lowest total ownership cost.

(ii) In evaluating the energy efficiency of the offerors an assessment will be made as to an adequate management system for energy being in place and utilized. Offerors and respondents shall show evidence of their management system for energy as proscribed in the applicable acquisition document. An adequate management system for energy will be a system that meets the standards of ANSI/MSE 2000:2008, the future ISO 50001 standard or an equivalent.

(iii) In evaluating an offeror's proposal for a building sufficient information shall be provided to ensure that procurements comply with DoD policy to build, operate, maintain, reuse, demolish or deconstruct built infrastructure in a sustainable manner. New buildings, structures, and major renovations shall be designed and built to conform to the principles in the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (MOU) dated January 24, 2006. Additionally, offerors shall provide information documenting a minimum Silver level of the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) green building system, or an equivalent third party green building rating system, with not less than 20% of the total points dedicated toward energy efficiency and water conservation.

D. FURTHER STUDY

- What is the proper timeframe for deciding return-on-investment decisions for the Navy? Is it 10, 20, or 30 years, and more?
- Would establishing a strong position in the program office for a sustainability manager be able to effectively counter the current disincentive that exists for the program manager to make investment decisions based upon total ownership cost that raise the initial acquisition cost.

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF REFERENCES

- American National Standards Institute (ANSI). (n.d.). *About ANSI overview*. Retrieved April 2, 2010, from http://ansi.org/about_ansi/overview/overview.aspx?menuid=1
- Arnseth, L. (2009, September). Wal-Mart's sustainability index. *Inside Supply Management*, 9, 19–21.
- Bochman, A. (2009). Measure, manage, win: The case for operational energy metrics. *Joint Forces Quarterly*, 113–119.
- Butler, A. (2008, October 31). Aerospace Daily & Defense Report. *Price shootout an option for next tanker competition*. Retrieved March 31, 2010, from <http://www.lexisnexis.com/us/lnacademic/search/homesubmitForm.do>
- Corley, R. M. (2009, September). *Evaluating the impact of the fully burdened cost of fuel* (Master's Thesis). Monterey, CA: Naval Postgraduate School.
- Defense Acquisition Executive. (2010, March 29–30). Remarks delivered at the Secretary of the Navy's Energy Efficiency Summit, Arlington, VA.
- Defense Acquisition University (DAU). (2008). *Introduction to defense acquisition management*. Retrieved December 14, 2009, from <https://acc.dau.mil/CommunityBrowser.aspx?id=18522&lang=en-U.S>.
- Defense Acquisition University (DAU). (2009, October 1). *Interim defense acquisition guidebook*. Retrieved December 14, 2009, from <https://acc.dau.mil/CommunityBrowser.aspx?id=314716>
- Defense Acquisition University (DAU). (2010). *Defense acquisition guidebook*. Retrieved May 10, 2010, from <http://akss.dau.mil/dag>
- Defense Acquisition University (DAU). (n.d.). *Socio-economic programs*. Retrieved December 14, 2009, from <https://acc.dau.mil/CommunityBrowser.aspx?id=24931>
- Defense Science Board (DSB) Task Force on DoD Energy Strategy. (2008). *More fight–less fuel*. Office of the Under Secretary of Defense (Acquisition, Technology & Logistics). Washington, DC: Author.
- Defense Science Board (DSB) Task Force on Improving Fuel Efficiency of Weapons Platforms. (2001). *More capable warfighting through reduced fuel burden*. Office of the Under Secretary of Defense (Acquisition, Technology & Logistics). Washington, DC: Author.

- Department of Defense (DoD). (2010, February). *Quadrennial Defense Review*. Washington, DC: Author.
- Department of Energy (DoE). (2009a). *About the program*. Retrieved December 14, 2009, from <http://www1.eere.energy.gov/femp/about/about.html>
- Department of Energy (DoE). (2009b). *Federal energy management program: Energy awareness month frequently asked questions*. Retrieved December 14, 2009, from http://www1.eere.energy.gov/femp/services/energy_aware_faqs.html
- Department of Energy (DoE). (2010). *Facilitating sound, cost-effective energy management*. Retrieved March 14, 2010, from http://www1.eere.energy.gov/femp/pdfs/femp_fs.pdf
- DiPetto, C. (2006, November 8). Energy leadership: A fuel efficient force. Unpublished PowerPoint Presentation. 2006 PEO/SYSCOM Commander's Conference.
- Dipetto, C. (2008, March 13). *Prepared testimony*. Testimony before the United States House Committee on Armed Services Readiness Subcommittee, United States House of Representatives. Retrieved December 14, 2009, from www.DoD.mil/DoDgc/olc/docs/testDipetto080313.pdf
- Energetics Incorporated. (2010). *Achieving superior energy performance—energy management standard*. Retrieved April 2, 2010, from <http://www.superiorenergyperformance.net/ems.html>
- Engels, D. (1978). *Alexander the Great and the logistics of the Macedonian army*. Berkeley, CA: University of California Press.
- Environmental Protection Agency (EPA). (2009). *Wastes, resource conservation, comprehensive procurement*. Retrieved March 14, 2010, from <http://www.epa.gov/epawaste/conservation/tools/cpg/index.htm>
- Environmental Protection Agency (EPA). (2010a). *Environmentally preferable purchasing (EPP)*. Retrieved March 14, 2010, from <http://www.epa.gov/epp/>
- Environmental Protection Agency (EPA). (2010b). *How a product earns the energy star label*. Retrieved March 14, 2010, from http://www.energystar.gov/index.cfm?c=products.pr_how_earn
- Fein, J. (2010). Defense Daily. *Navy looks to get its arms around TOC, early initiatives are paying off*. Retrieved May 26, 2010, from <http://www.lexisnexis.com/us/lnacademic/search/homesubmitForm.do>

- Garrett, G. (2007). *World class contracting* (4th ed.). Chicago, IL: CCH.
- General Accounting Office (GAO). (2008a). *Overarching organizational framework needed to guide and oversee energy reduction efforts for military operations* (GAO-08-426). Washington, DC: Author.
- General Accounting Office (GAO). (2008b). *Defense management: Overarching organizational framework could improve DoD's management of energy reduction efforts for military operations* (GAO-08-523T). Washington, DC: Author.
- General Services Administration (GSA), Department of Defense, National Aeronautics and Space Administration. (2009, December 10). *Federal acquisition regulation (FAR)*. Retrieved December 14, 2009, from <https://www.acquisition.gov/far/current/pdf/FAR.pdf>
- Georgia Tech Energy and Environmental Center (GTEEC). (2007a). *ANSI/MSE 2000:2008*. Retrieved April 2, 2010, from <http://mse2000.net>
- Georgia Tech Energy and Environmental Center (GTEEC). (2007b). *MSE overview*. Retrieved April 2, 2010, from <http://mse2000.net/mseoverview/tabid/54/default.aspx>
- Herrera, T. (2010, March 15). *Walmart's emerging role in sustainability consulting*. Retrieved March 21, 2010, from <http://greenbiz.com/print/33452>
- Integrated Renewable Energy. (2010). *Energy consulting and solutions*. Retrieved April 2, 2010, from <http://www.integratedrenewableenergy.com/isoComparison.php>
- ISO. (2006) *ISO in brief*. Retrieved April 2, 2010, from http://www.iso.org/iso/isoinbrief_2006-en.pdf
- ISO. (n.d.a). *About ISO*. Retrieved April 2, 2010, from <http://www.iso.org/iso/about>
- ISO. (n.d.b). *Discover ISO*. Retrieved April 2, 2010, from http://www.iso.org/iso/about/discover-ISO_what-standards-do.htm
- ISO. (n.d.c). *General information on ISO*. Retrieved April 2, 2010, from http://www.iso.org/iso/support/faqs/faqs_general_information_on_iso.htm
- ISO. (n.d.d). *ISO standards*. Retrieved April 2, 2010, from http://www.iso.org/iso/iso_catalogue

- The JASON Group (JASON). (2006, September). *Reducing DoD fossil-fuel dependence* (JSR-06-135). McLean, VA: Author.
- Jean, G. V. (2010). *Navy's energy reform initiatives raise concerns among shipbuilders*. Retrieved March 18, 2010, from <http://www.nationaldefensemagazine.org/archive/2010/April/Pages/NavyEnergyReformRaiseConcers.aspx>
- Krieger, J. & Wood, R. (2009, July–August). Breaking the camel's back: If only DoD operated as a business. *Defense Acquisition Technology & Logistics (AT&L)*, 38(5), 8–13.
- Mabus, R. (2009, October 14). Remarks delivered at the Navy Energy Forum, McLean, VA.
- Meffert, B., & McKane, A. (2009, May). *Development of an energy management standard: ISO 50001*. Retrieved April 2, 2010, from http://www.superiorenergyperformance.net/pdfs/iso50001_May09.pdf
- National Institute of Standards & Technology. (February 1993). *More questions and answers on the ISO 9000 standard series and related issues*. Retrieved May 2, 2010, from <http://ts.nist.gov/standards/conformity/ir5122.cfm>
- Office of the Assistant Secretary of the Army (Acquisition Logistics and Technology). (2009, January 7). *Energy productivity in U.S. Army weapon systems*. Memorandum. Washington, DC: Author.
- Office of the Press Secretary. (2009a). *National energy awareness month, 2009*. Retrieved December 14, 2009, from http://www.whitehouse.gov/the_press_office/Presidential-Proclamation-National-Energy-Awareness-Month
- Office of the Press Secretary. (2009b). *President Obama signs an executive order focused on federal leadership in environmental, energy, and economic performance*. Retrieved December 14, 2009, from <http://www.whitehouse.gov/administration/eop/ceq/sustainability>
- Organizing for America. (2010). *It's your choice: How the candidates stand on the issues that matter to you*. Retrieved May 25, 2010, from http://my.barackobama.com/page/content/newenergy_campaign
- Pinero, E. (2009, September). *Future ISO 50001 for energy management systems*. Retrieved April 2, 2010, from http://www.iso.org/iso/iso-focus_2009-09_p18__mainfocus.pdf

- Rutherford, E. (2010, January 14). Wittman: 313-ship navy fleet needed but not on horizon. *Defense Daily*. Retrieved May 25, 2010, from http://www.defensedaily.com/sectors/congress/Wittman-313-Ship-Navy-Fleet-Needed-But-Not-On-Horizon_9076.html
- Under Secretary of Defense (AT&L). (2007, November 20). *The defense acquisition system* (DoD Directive 5000.01). Washington, DC: Author.
- Under Secretary of Defense (AT&L). (2008, December 8). *Operation of the defense acquisition system* (DoD Instruction 5000.02). Washington, DC: Author.
- U.S. Air Force. (2010). *Air Force energy plan 2010*. Retrieved March 1, 2010, from <http://www.safie.hq.af.mil/shared/media/document/afd-091208-027pdf>
- U.S. Army. (2004). *The Army strategy for the environment: Sustain the mission—secure the future*. Retrieved March 1, 2010, from <http://www.asaie.army.mil/public/esoh/doc/armyenvstrategy.pdf>
- U.S. Army. (2009). *Army energy security implementation strategy*. Retrieved March 1, 2010, from http://www.asaie.army.mil/public/partnership/doc/aesis_13Jan09_approved%204-03-09.pdf
- U.S. Green Building Council (USGBC). (2010). *LEED rating systems*. Retrieved May 26, 2010, from <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222>
- U.S. House of Representatives. (2008). *Duncan Hunter national defense authorization act for fiscal year 2009* (H.R. 5658). 110th Congress, 2nd Session. Retrieved May 26, 2010, from <http://www.govtrack.us/congress/bill.xpd?bill=h110-5658>
- Wal-Mart. (2010). *Global sustainability report*. Retrieved March 21, 2010, from <http://cdn.walmartstores.com/sites/sustainabilityreport/2010/wmt2010global sustainabilityreport.pdf>
- Wal-Mart. (n.d.a). *Climate and Walmart's suppliers*. Retrieved March 21, 2010, from <http://walmartstores.com/sustainability/9553.aspx>
- Wal-Mart. (n.d.b). *Sustainability index*. Retrieved May 2, 2010, from <http://walmartstores.com/sustainability/9292.aspx>
- Walmart. (2009). *Sustainability supplier assessment questions*. Unpublished PowerPoint presentation. Supplier Sustainability Assessment, Walmart.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
Ft. Belvoir, Virginia
2. Dudley Knox Library
Naval Postgraduate School
Monterey, California
3. CAPT James Barnard
NAVSEA CODE 02
Washington, D.C.
4. Gabrielle Trickett
Office of the Deputy Assistant Secretary of the Navy (A&LM)
Washington, D.C.
5. Professor E. Cory Yoder
Naval Postgraduate School
Monterey, California
6. Professor Max Kidalov
Naval Postgraduate School
Monterey, California